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ABSTRACT

Nine papers illustrate the management considerations that arise in programmatic research and development in education and indicate how these considerations have been handled in one situation. (Author)

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Educational R&D Program Management Considerations

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Richard E. Schutz

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Nine papers illustrate the management considerations that arise in programmatic research and development in education and indicate how these have been handled in one situation.

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EDUCATIONAL R&D PROGRAM MANAGEMENT CONSIDERATIONS

Programmatic research and development is a new phenomenon in education. Prior to the establishment of the federally-funded Educational Laboratories in 1966, no institutional capability for such effort existed apart from colleges and universities. This void in the educational sector is in marked contrast to the 723 R&D installations supported by federal agencies in fields other than education (National Science Foundation, 1970).

Given this situation, it is not surprising that the management considerations which distinguish institutional programmatic R&D from university project R&D are poorly understood within the educational community, even by its most active and capable R&D and governmental personnel. A large and significant conceptual imbalance requires readjustment. The papers collected here were not prepared for that purpose but may modestly contribute to that end. The documents were produced as internal SWRL working papers to solve specific Laboratory problems or to address specific Laboratory issues, and as such do not purport to be either comprehensive or exhaustive. Collectively, they illustrate at least a subset of the management considerations which do arise in an institutional R&D context and suggest how these have been handled in one situation.

The documents represent the collaborative effort of the senior members of the SWRL Directorate: Robert L. Baker, Harry Handler, William H. Hein, and Richard E. Schutz. The individual preparing the first draft of each document is indicated in the following overview, but each person had a full hand in each document before it reached its present state.

Elements of a Comprehensive Educational Research and Development Program. One of the problems in conducting programmatic research and development in education at the present time is that the traditional pedagogical dimensions of subject-content disciplines and age-grade levels provide poor boundaries for describing or guiding the effort. Expansion of the matrix by adding such considerations as "target populations" and "professional characteristics," while of possible interest to school personnel, is of no energizing or management value to the R&D personnel. The paper draws upon the experience of large-scale R&D enterprises outside of education to adapt categories of effort with demonstrated utility to the unique characteristics of education. The resulting framework is wishful at the present time, but operationalizable at any time (Schutz).

Subsystems of an Educational Program. Critics of educational R&D take pleasure in pointing out that education requires more than materials and other physical artifacts, irrespective of how carefully and effectively

these are organized. This question-begging statement is no revelation to the R&D professional. However, the basis for joining and accommodating the differential requirements of R&D and practice in education has been lacking. The paper presents a perspective of an educational program as comprising several subsystems with interdependent but distinguishably different development objectives, technology, and outcomes (Handler).

Characteristics of Educational Program Systems. This is a companion to the previous paper. The subsystems delineated share certain common characteristics. These commonalities provide structures which development personnel can use in designing their systems and organizing their development activities (Baker).

The Self-Corrective Mechanism Applied to the Organization of a Laboratory. This paper chronicles the institutional progress of one laboratory from a collection of projects to a matrix of activities and functions which provide a structure for continuous programmatic R&D effort. The structure incorporates control points for informed management and for resource allocation. It also energizes definable completed outcomes at successively higher levels of sophistication and effectiveness (Schutz).

Program Planning Guidelines. An R&D program which is all dynamism has no basis for cumulation, cohesion, or completion. Alternatively, an R&D program which is all control has no basis for creativity, fertility, or individuality. The guidelines aspire to provide boundaries for a channel between these undesirable extremes (Schutz).

Guidelines for the Preparation and Review of Task Schedules. The systematic implementation of the Program Planning Guidelines provides the basis for a continuously current report of the status of the work program. The uncomplicated procedure underlying this management information system is illustrated by the procedures for preparing, reviewing, updating task schedules and briefing management on their status (Baker).

Program Documentation Guidelines. Insuring that R&D efforts become a matter of record has several positive consequences. It makes explicit the status of the effort at any given time. It avoids repeatedly retraversing the same paths. It contributes to enhanced organizational intelligence and capability. It provides the potential for technology transfer outside the organization. Despite these advantages, effective documentation does not occur naturally. Unless the documentation of R&D effort is given specific priority, it loses in the competition with less onerous and more immediately pressing day-to-day activities. The guidelines aspire to provide a minimally complex and maximally manageable mechanism for structuring and encouraging R&D documentation (Schutz).

Management Rules of Thumb. Teem's First Law (John M. Teem, Director, Technical Staff, Research and Development, Xerox Corporation) states that there are no problems other than people. A corollary could be that there are not people without problems. The law and its corollary set the bounds

for an appreciable share of R&D management activity. Recognizing the primitive status of R&D management science and technology, the first ten rules of thumb were codified during the first week of SWRL operation. The eleventh rule was added during the second year. While far from being chiseled in stone, the rules have thumbed well (Schutz).

Control Points in Laboratory Operations. Management personnel frequently aspire to continuous information and control. This is an unreasonable and unfeasible aspiration in a programmatic educational R&D context. A perspective which views control in terms of a point rather than a continuous distribution is both more enjoyable and accountable for all parties concerned. The paper illustrates the application of these perspectives within the business operations sector of the Laboratory (Hein).

The collected papers reflect the management perspective of SWRL but they do not, of course, circumscribe the management documentation of the Laboratory. This is additionally included in Board Policies, Administrative Procedures, Professional Guidelines, Manuals, and more importantly, in lore which accumulates in and among individual members of the Laboratory staff.

Reference

National Science Foundation. Directory of federal R&D institutions. NSF 70-23, 1970.

ELEMENTS OF A COMPREHENSIVE EDUCATIONAL RESEARCH AND DEVELOPMENT PROGRAM

The most popular prevailing view of educational research and development categories is in terms of research, development, evaluation, and diffusion. The disadvantages of the linear perspective have been noted in the review of educational research and development policy in the United States conducted by the Organization for Economic Cooperation and Development (National Center for Educational Research and Development, 1969), but OECD did not suggest an alternative framework.

The R&D programs of such mission-oriented agencies as NASA and DOD provide a useful experience base for an alternative perspective. While the characteristics of space exploration and national defense unquestionably differ from education, it appears reasonable that a "technology transfer" from these sectors at the conceptual R&D framework level is a possibility worthy of consideration.

The following discussion borrows heavily from a survey of DOD research and development management categories presented by Thomas K. Glennan (1967). Glennan's categorizations are paraphrased and freely adapted to reflect and incorporate the unique characteristics of the educational context. A brief description of the areas of endeavor is followed by a specification of suggested prerequisite criteria for initiating an effort within each of the areas. It is important to note that the categories are coordinate, not linear.

Fundamental research includes all efforts directed toward increased knowledge of natural phenomena and environment and toward solutions of problems in the physical, behavioral, and social sciences. By definition, "research" includes all basic research in addition to applied research directed toward expanding knowledge in various scientific areas.

Exploratory development includes all efforts to resolve specific problems short of major development projects. These efforts may vary from fundamental applied research to sophisticated experimental studies and prototype tests. The dominant characteristics of this category of effort is that it is pointed toward specific problem areas, with a view toward developing and evaluating the feasibility and practicability of proposed solutions and determining their parameters.

Advanced development includes all efforts that have progressed to the development of systems for experimental or operational tests. Advanced development is characterized by the existence of prototypes and components designed for test or experimentation as opposed to those designed and constructed for eventual (sometime) educational use. The major distinction is in terms of readiness for use.

Operating program development includes research and development efforts directed toward the full development, engineering, and testing of all of the essential systems, support programs, vehicles, materials, and procedures that have been demonstrated ready for production and use by the schools.

Production/operation refers to the activities which take place after the full program has been developed. The effect on the operational environment is the test of the social utility of previous R&D efforts. Production and operation activities are always going on, irrespective of R&D input. The essence and ultimate criterion of success for R&D efforts is demonstrated improvement in both production and operation.

Decisions related to the initiation of the various R&D efforts must be based on criteria which provide direction for the allocation of resources. Prerequisite criteria for each of the R&D efforts are listed below.

Effort Initiation Criteria

Fundamental Research

1. The utility of the potential outcomes of the research is high.
2. The scientific or technological domain is judged to be ripe for exploration.
3. Talented scholars and scientists are available or recruitable.

Exploratory Development

1. The technical feasibility of a promising model is uncertain and warrants further investigation, or
2. A requirement for a prototype or component can be specified with sufficient precision to permit further effort to refine the specifications, or
3. Experimentation is required to investigate the parameters or performance limit of a prototype or component of a subsystem, or
4. The effort involves the testing of a model preparatory to the development of a prototype or component of a subsystem and the technology for such effort is available.

Advanced Development

1. A promising exploitable technology is available and the priority or magnitude of the effort is too great to warrant consideration as exploratory development, or the nature of the effort is such that more extensive management is required to insure continuity or cost control than is reasonable under an exploratory development effort.

2. Primarily development rather than experimental effort is required, and the technology needed is sufficiently in hand.

3. The system and performance objectives have been defined.

4. The best technical approaches have been selected.

5. A trade-off analysis of alternative system configurations has been made.

6. The cost effectiveness of the proposed item has been determined to be favorable in relationship to the cost effectiveness of extant items.

7. Cost and schedule estimates are credible and acceptable.

Operating Program Development

1. Primarily system articulation rather than system development effort is required, and the technology needed is sufficiently in hand.

2. The program and performance objectives are defined.

3. The best technical approaches have been selected.

4. A thorough trade-off analysis of alternative program configurations has been made.

5. The cost effectiveness of the proposed program has been determined to be favorable in relationship to the cost effectiveness of competing potential programs.

6. Cost and schedule estimates are credible and acceptable.

Production/Operation

1. All systems involved in a new operating program are available or a firm availability date can be projected.

2. The cost effectiveness of adopting the new program has been determined to be favorable when compared with that of the current operating program.

Effort Procurement Implications

The various R&D efforts have differential procurement implications. In the area of fundamental research, quality performance is dependent upon the individual researcher; thus the objective is to buy the time of the most talented research personnel. This may be done via RFPs or by inviting proposals in a generally defined area. In some popular areas of research, unsolicited proposals alone may generate an adequate effort level. While the sponsoring agency is likely to view the RFP as the best route for procuring the outcomes it deems necessary, the precision of R&D contracts following from an RFP is usually spurious. It is seldom possible to prepare RFP specifications which produce other than "hack" work. A competent researcher, if "hungry" and if he can see a clear route for sandbagging the contract specifications, will occasionally become associated with an RFP initiated contract. However, in such cases, one can almost be sure that the "good stuff" generated by the effort insofar as the researcher is concerned will be above and beyond the literal terms of the contract.

Exploratory development requires personnel possessing a high degree of both professional and mission judgment. It is unreasonable to expect to obtain this talent on an ad hoc or ad lib basis by contracting for individual services. Moreover, exploratory development efforts typically require technical support and equipment resources which are expensive to create under short-term contracts. For these reasons, the typical procurement route for such efforts is an institutional contract. Personnel associated with such institutions obtain neither the prestige satisfaction associated with fundamental research nor the financial satisfaction associated with commercial R&D efforts. The inducement to personnel involved in exploratory R&D is the satisfaction of incorporating research into a more usable form. This satisfaction is sufficient to attract and maintain quality personnel if the institutional setting is itself sufficiently stable to insure that this opportunity will not be whimsically withdrawn. It is difficult to provide such assurance under conditions other than long-term institutional contracts.

Advanced development efforts as viewed here are of a sufficient magnitude (millions of dollars) and/or duration (at least three years) to warrant management as major projects. The quantity of resources devoted to such projects collectively may vary from year to year, depending upon budget availability and the number of projects that pass the test of value versus cost. Thus, while instability of overall funding in this category may be expected, there must be sufficient

stability to maintain a pool of contractors and personnel teams. It should be noted that such a resource pool does not currently exist since there is currently no stable market for such services.

Operating program development activities involve interface activities between completed systems and operational educational programs. The assembly of systems into programs and installing the new program on a wide-scale basis is still virgin territory in education, although at least a few Educational Laboratories have explored it initially. Unless modifications are made in funding support for public education, the most typical procurement mechanism for operating program development activities would be categorical school aid. This domain is essentially that of ESEA 1965, Title III. The difference is that reasonable prior R&D effort which was lacking in the 1960's will have yielded outcomes that make possible the attainment of the original objectives in the 1970's.

Production/operation is the category of the private marketplace and public school finance. This is not an R&D category. It is included here to make explicit that specific attention must be given to advance planning of procurement alternatives at this level if the results of programmatic R&D effort are ever to be implemented. At the present time the inducement of manufacturers to produce better instructional programs is extremely weak; there is no great market demand. Alternatively, the schools are in no position to afford installing new instructional programs; many are near bankruptcy. The efforts of the President's Commission on School Finance will in part address this situation and will hopefully ameliorate at least the school finance side of the relationship.

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SUBSYSTEMS OF AN EDUCATIONAL PROGRAM

From a development perspective an educational program may be considered as comprising several subsystems. Each subsystem has interdependent but distinguishably different development objectives, technology, and outcomes. A brief description of the subsystems is followed by a specification of the characteristics of each in terms of R&D objectives.

Instructional systems. An instructional system refers to the research-based methods and materials prepared to accomplish specified instructional outcomes under natural conditions. The instructional system includes everything needed by a local agency to obtain specified instructional outcomes (behaviors). A system, therefore, includes specification of instructional outcomes, student materials, instructor procedures (where instructor might be a parent, a teacher, or community volunteer), delivery mechanism for delivering the student material to the student (and possibly for analyzing his responses), performance indicators (test-like procedures) which are used for evaluating student progress, for diagnosing student learning difficulties and for instructor and instructional system accountability.

Training systems. A training system refers to the materials and procedures required to train the human resources that will be in direct contact with the pupil and have the ultimate responsibility for various phases of instruction. In addition to the teacher, these human resources include parents, tutors, aides, etc. The training system must be designed in such a way as to effectively train all personnel involved in the teaching process in a specified manner consistent with the instructional requirements of the instructional system. This category inclues a number of the dimensions of classroom management; suggestions related to grouping procedures, the allocation of time, the sequencing of instruction, the pacing of instruction, etc.

Installation systems. The installation system consists of the procedures and materials required by a local educational agency to effectively introduce an instructional program. It provides for those considerations related to the administration of the schools and includes persons with direct administrative authority and responsibility for supervisory service, curriculum, and pupil personnel services. This system includes briefing information about the instructional program, procedures for providing various categories of agency personnel with pupil performance data in a form they find manageable and useful, and materials which can be used for public information purposes.

Accountability systems. An accountability system refers to the procedures and materials required to continuously evaluate each of the above-mentioned systems, i.e., the instructional system, the training system, and the installation system. The instructional system

is evaluated in terms of teacher behaviors related to instructional program requirements. The installation systems is evaluated in terms of awareness and understanding of all district personnel of the purposes of the instructional program and the extent to which the program is installed and understood throughout the agency.

Modification systems. A modification system refers to the procedures, materials, and strategies required to analyze the operation of the preceding systems, detect specific limitations of the systems, and apply appropriate decision rules to effect modifications or revisions designed to improve program performance.

Systems Objectives

Instructional Systems

1. Statement of anticipated observable student outcomes.
2. Criterion measures to determine the accomplishment of the outcomes.
3. Student instructional materials.
4. Statement of learner prerequisites in terms of initial proficiency the learner must exhibit.
5. Statement of the teacher's instructional responsibilities.
6. Evidence that the system has yielded dependable results.
7. Data concerning instructional time and study time requirements.
8. Statement of direct and indirect costs.

Training Systems

1. Statement of personnel requirements and interrelationships (e.g., teachers, tutors, parents, aides, etc.)
2. For each personnel category identified, proficiency anticipated at the end of training and in conducting the instructional program.
3. Measurement procedures to determine the accomplishment of the training outcomes.
4. Instructional materials for each category of trainees.
5. Instructional materials for trainers.

6. Feasible alternative plans for sequencing and scheduling training for each trainee category.

7. Evidence that the system has yielded dependable results.

8. Statement of direct and indirect costs.

Installation Systems

1. Materials for use by installing agency to describe a program at a "public information" level suitable for at least the following audiences: governance group, operating staff, general public.

2. Statement of feasible procedures for procuring instructional and training system materials.

3. Statement of anticipated required revisions in prevailing personnel and/or administrative policies.

4. Statement of feasible procedures for required personnel assignment and scheduling.

5. Statement of feasible alternatives for training of training-supervisors.

6. Statement of anticipated administrative requirements for maintaining the program.

7. Statement of alternative options where the new program interfaces with remaining extant programs.

8. Evidence that the system has yielded dependable results.

9. Statement of direct and indirect costs.

Accountability Systems

1. Assessment devices for all program outcomes for which accountability is to be maintained, related both to pupil proficiency and to systems procedural adequacy.

2. A human resources analysis which may be used as a basis for differentiating and assigning accountable responsibility.

3. A data collection and reporting procedure for maintaining accurate and timely bench mark information.

4. Statement of consequences or alternatives to be effected if performance at a given bench mark test is determined to be unacceptably low.

5. Available forms and/or equipment to operate and report the bench mark tests.

6. Evidence that the system has yielded dependable results.

7. Statement of direct and indirect costs.

Modification Systems

1. Statement of procedures for insuring that data related to the performance of each of the subsystems comprising the program will be made publicly available.

2. A statement of decision rules for correcting deviations from the prescribed manner in which each of the preceding systems is designed to operate.

3. Suggestions for temporary stop-gap actions to ameliorate identified frailties in the preceding systems until more systematic action can be taken.

4. Provisions for documenting identified sources of "system-breakdown" and "system remediation."

CHARACTERISTICS OF EDUCATIONAL PROGRAM SYSTEMS

1. OUTCOMES. Explicit statements of the outcomes, or the expectations for a system, are required. Such statements should be precise, defining all performance characteristics operationally. When the outcome is a product (e.g., learner responses to a test or a term paper), its characteristics should be fully described and the tolerance limits of an acceptable product specified. When the outcome is a process (e.g., inquiry techniques or teacher-learner planning), it is equally necessary to define its identifying characteristics fully. It is especially important to go beyond the use of a slogan, which tends merely to obscure the complexity of a poorly understood and inadequately described phenomenon. Sometimes the characteristics of the process outcome can be assessed simply in terms of their presence or absence. Statements of outcomes are critical, for they constitute the basis for all other systems' specifications.

2. INSTRUCTION. This characteristic--common, like the others, to all systems--includes all the instructional specifications, the prototype materials and methods designed to conform to the specifications, the production of materials and procedures in a form suitable for appropriate testing, the actual testing of prototype materials and procedures, and the resultant instructional product--packaged and introduced in such a way as to make it attractive to the learner. Prototype testing involves the administration of criterion referenced tests to a representative target population, and the initial tryout of prototype instruction with a single learner or a single group of learners. All prototype materials must be in a replicable form. That is, the developer may <u>not</u> specify that a "creative" or a "well-educated" teacher is required unless he indicates precisely how such creative behavior can be identified.

3. QUALITY VERIFICATION. No system element, either in education or any other context, is likely to function adequately the first time it is tried under natural conditions. Quality verification activities therefore involve the successive trial-revision cycles required to bring a system or its elements to an acceptable level of performance under complex "real-world" conditions. Within the corrective cycles designed to identify and eliminate defects until the system satisfies current user requirements adequately, the three key concepts are tryout, evaluation, and revision.

4. MONITORING. This characteristic refers to the development and deployment of various techniques to keep system efficiency at a high level, consistent with state-of-the-art resources. Emphasis usually falls upon the identification of monitoring requirements which will

identify and effect desirable system changes. Especially critical is the definition of decision rules (e.g., given outcome X, procedure Y is required) to insure achievement of en route outcomes and the design of materials and procedures necessary to implement the decision rules.

5. PERSONNEL. The present view of instructional product development engenders a different view of human resource utilization than has been characteristic in the past. The outcome-referenced methods and materials, comprising an instructional program or system in the modern sense, constitute a base for the management of human resources which will lead to more efficient administration of instruction and a greater likelihood that the prespecified outcomes will be attained. Our view of the human resource network moves from the involvement of individuals at the instructional level, to the involvement of staff groups at the support level, to the involvement of institutions at the agency level. Each part of the network has defined responsibilities for promoting or verifying the desired outcomes of each aspect of the particular system. By making specific provisions for all individuals involved in the system, the network helps insure that the human resources for satisfying accountability requirements can be increased dramatically. It is thus apparent that, in addition to satisfying the requirements related to the assignment and scheduling of personnel, this view of a functional human resource network generates new professional training requirements as well as new job functions.

6. DATA. Each of the five instructional program systems has its own unique data requirements. No matter how special their requirements may be, however, it is apparent that one system's data requirements will necessarily involve the data requirements of one or more of the other systems. Especially critical are the mechanisms and procedures utilized by a system for the collection and analysis of data. It is always important to specify the data requirements fully as they suggest potential interference with the operations of other systems. It is also important to specify the resource requirements, primarily personnel, materials, and computers. Finally, data analysis must generate information that is usable, not merely reportable.

7. INTERFACES. This characteristic refers to important, but frequently ignored factors stemming from the fact that each program system, as we have seen, entails requirements that must be related in some way to existing programs, policies, and people. Thus an analysis of the new system requirements as reflected against existing structures is vital. Objectives growing out of this analysis will generate suggested revisions in prevailing instructional, personnel, and administrative policies. Where present structures are inviolate, revisions must be made in the system.

8. PROCUREMENT. Inasmuch as each of the systems has both common and unique resource requirements, it is important to predetermine requirements, insofar as is possible, and to study the feasibility of establishing procurement procedures. Emphasis in this area falls upon the specification of procurement procedures and the allocation of nonhuman resources.

9. INFORMATION. Both the developer of instructional systems and the consumer-participant have specific information requirements. In each case, the concern is with a certain kind of information, as well as with some general public information commonly disseminated by most public information offices. Because the interrelationships between the various elements of the systems reflect the total environment in which any system's utility must be proven, it is important that outcomes be specified, and that materials and procedures be developed, for use in describing a system at a "public information" level, suitable for at least the governance group and the general public. Also necessary will be an information level for the operating staff and interested professional sectors which will include sufficient description for an understanding of the technical aspects of the systems. Finally, although it is not easy to establish communication with a user who has a different set of values and frame of reference from the developer, communication must be established here too; usually, the producer will have to initiate the communication.

10. CONTINUITY. In an effective development effort, one always has the "next generation" product underway before the "current generation" product is fully developed. This progressive accumulation of development effort requires not only a criterion referenced outlook but a continuous development operational procedure which has not existed in education heretofore. This kind of continuous refinement of a product or system requires clearly prespecified procedures relating to documentation, analysis, and reporting. Central to this characteristic are strategies for devising effective modifications in tryout and revision procedures, statements of next steps in development, and statements of changes to be incorporated in the product or in system procedures.

11. COSTS. Because costs constitute a sensitive area for the consumer, they require full attention on the part of the producer. Assuming that one has sufficient evidence that a system yields dependable results, he must ask: what are the costs involved in such a yield? This area requires identification of the various cost factors and ratios. One critical set of outcomes suggested by the not-yet fully validated concept of "cost effectiveness" and not yet represented by a well defined set of formulae, is the relationship between the utility and the reliability of a system's effect and its associated direct and indrect costs. Increasing attention needs to be devoted to objectives and procedures focusing on that relationship.

PROGRAM SYSTEMS	SYSTEM CHARACTERISTICS										
	1 OUTCOMES	2 INSTRUC-TION	3 QUALITY VERIFICA-TION	4 MONITORING	5 PERSONNEL	6 DATA	7 INTERFACES	8 PROCURE-MENT	9 INFORMA-TION	10 CONTINUITY	11 COSTS
Instructional											
Training											
Installation			A								
Accountability											
Modification											

FIGURE 1. A Guide for the Specification of Instructional Program Requirements, Materials, and Procedures

The two dimensions described above--instructional program systems and systems characteristics--can be represented graphically in a two-way matrix guide which facilitates the specification of requirements, outcomes, and procedures unique to each intersection. Figure 1 illustrates the interrelations of program systems and system characteristics in this fashion. Look, for example, at the cell outlined and lettered A, relating to the following two-dimension intersection:

I	Program System	⟶	"Installation"
II	System Characteristic	⟶	"Quality Verification"

The requirements for this cell are dependent, first and foremost, upon the tasks that must be specified. We know that potentially this cell includes tasks as diverse as, say, an analysis of the instructional program in order to determine appropriate points for various assessments, and, perhaps, the development of teacher performance scales to be used in determining effectiveness of specified installation procedures. The second question, clearly, is <u>who</u> is going to perform the task. Instructional development is so specialized that we should no longer accept the inadequacies of the "one on one" offense. A development team should be assembled, and the responsibilities of its members differentiated, in such a way that maximum expertise is applied at all points. In turn, this creates management requirements designed to insure that the specialized work of one becomes the sequenced work of all, rather than the diffused work of everyone.

THE SELF-CORRECTIVE MECHANISM APPLIED TO THE ORGANIZATION OF A LABORATORY

A self-correcting mechanism in a process indicates continuous evaluation as one of the components of the process. From the inception of the Southwest Regional Laboratory the self-correcting mechanism has been applied to all aspects of the program. The self-correcting mechanism has proved as applicable to the structure of the Laboratory as to its activities. The application has had several desirable effects. First and foremost, it has been instrumental in clarifying Laboratory purposes and objectives. SWRL began development in February, 1966, as a concept -- a prospectus which set ambitious but achievable objectives. As the Laboratory program has progressed, the willingness to question the effectiveness of the organization has not only provided improved guidelines for structuring, but has also accelerated Laboratory productivity.

Second, the successive modifications have enabled the Laboratory to maintain flexibility with concomitant stability. Had the Laboratory attempted to carefully pre-define the specifications for each staff position and restricted its recruiting to perform the tasks prescribed, a recommended personnel procedure, there would still be vacancies, and much of our creative talent would have gone untapped. Application of the self-correcting mechanism has made it possible to develop personnel functions that prevent the perpetuation of "dead jobs" while providing job security for capable employees.

It would be inaccurate to imply that any of the organization modifications were easy and natural for all members of the staff. Each has been accompanied by some temporary stress; however, each period of stress has been short-lived. The changes in physical office space that have typically accompanied the organizational changes appear to have been more traumatic than the changes in personnel relationships. However, "moving" has become almost a Laboratory way of life. Certainly, it would have been very difficult to effect the same degree of organizational change in one single major shift that has been achieved in the series of minor modifications.

Finally, the resultant modifications have oriented the Laboratory away from a structure which assesses performance in terms of bureaucratic roles to a mission-oriented structure which assesses performance in terms of demonstrable accomplishments. Educational institutions have traditionally emphasized the "who" and "where" aspects of program activities. SWRL has successively de-emphasized these concerns as the organization has moved toward a "flat" structure composed of functional program elements and away from hierarchical layers of administrative units.

The nature of the modifications can be most easily described in terms of the organizational charts documenting the changes. The first chart (Figure 1) was prepared during the planning period before the Laboratory became operational. It presents a detailed administrative

PROPOSED

ORGANIZATION CHART

SOUTHWEST REGIONAL LABORATORY

FOR EDUCATIONAL RESEARCH AND DEVELOPMENT

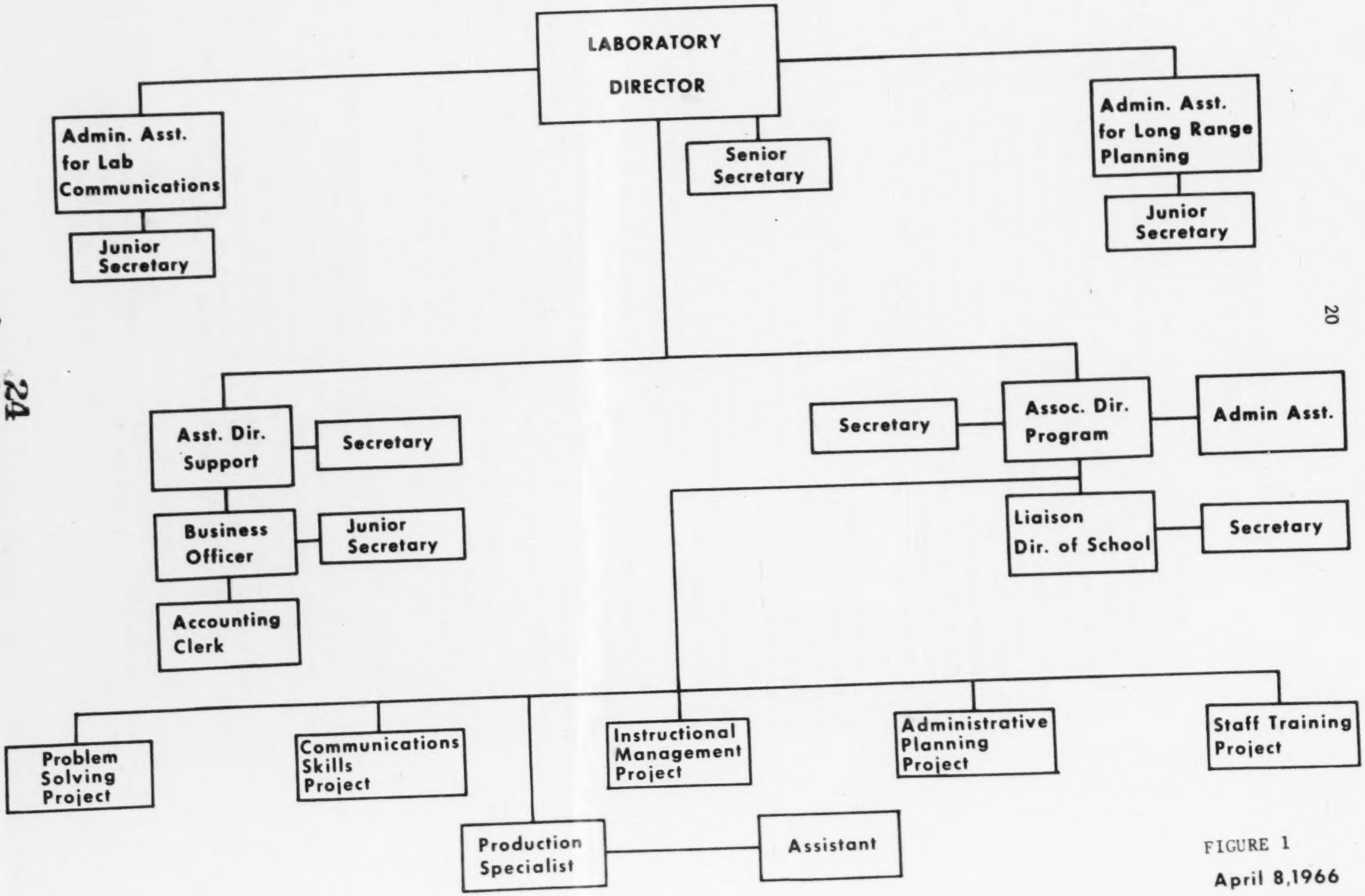

FIGURE 1

April 8,1966

structure superimposed over five discrete operational projects. The Laboratory director has two administrative assistants and two associate directors. Each associate director has a small personal staff. A production specialist and assistant dangle below the projects. The organization is a conventional administrative-operations structure.

Had it been possible to fill immediately each of the eight administrative positions shown on the original organization chart, it is likely that there would have been fewer subsequent modifications in the organization. However, even the simplified chart (Figure 2) prepared during the first month of operation is more elaborate than the actual staff organization at that time. Each of the three positions in Laboratory Communications as well as the Business Officer position was held by temporary summer undergraduate student-employees. The project staff personnel were largely teachers and graduate students hired for the summer.

The Laboratory did, however, conduct activities in each of the projects comprising the initial program approved by the Board of Directors. Since activities in Instructional Technology were initiated through a subcontract with System Development Corporation and Staff Training was manned by personnel housed in Tempe, Arizona, the principal growth in the Laboratory staff occurred in the Communication Skills and Problem Solving projects. By late fall 1966, the staff of each of these two projects had grown to approximately fifteen personnel. Moreover, each project had reached the stage where prototype instructional materials had been produced, and the initial tryout of the materials was underway in the schools.

It became increasingly obvious that continued expansion of the two curriculum projects in the conventional direction would lead to increased duplication and conflict of efforts in terms of the total Laboratory structure. Each project found it most convenient to request its own logistic support system -- its own artists, its own people to make contacts with the schools, etc. The direction was clearly toward independent projects, with no greater compatibility than the subject-matter/discipline departments of schools and colleges. Since this would hardly promote the programmatic objectives of the Laboratory, a further differentiation of functions was separated as shown in Figure 3. Communication Skills and Problem Solving were still intact modules, but were now responsible solely for conducting the research that would lead to the development of specifications for instruction. The Production module under Instructional Development was responsible for converting the specifications into materials and procedures comprising a product suitable for classroom tryout. The actual conduct of the evaluation-revision cycles was the responsibility of the Quality Verification module.

At the same time, the "administration" of the Laboratory was converted to a new role. The planning, coordinating, and review functions relating to internal Laboratory activities appeared most appropriately considered as support to the remainder of the Laboratory

FUNCTIONAL
ORGANIZATION CHART

SOUTHWEST REGIONAL LABORATORY
FOR EDUCATIONAL RESEARCH AND DEVELOPMENT

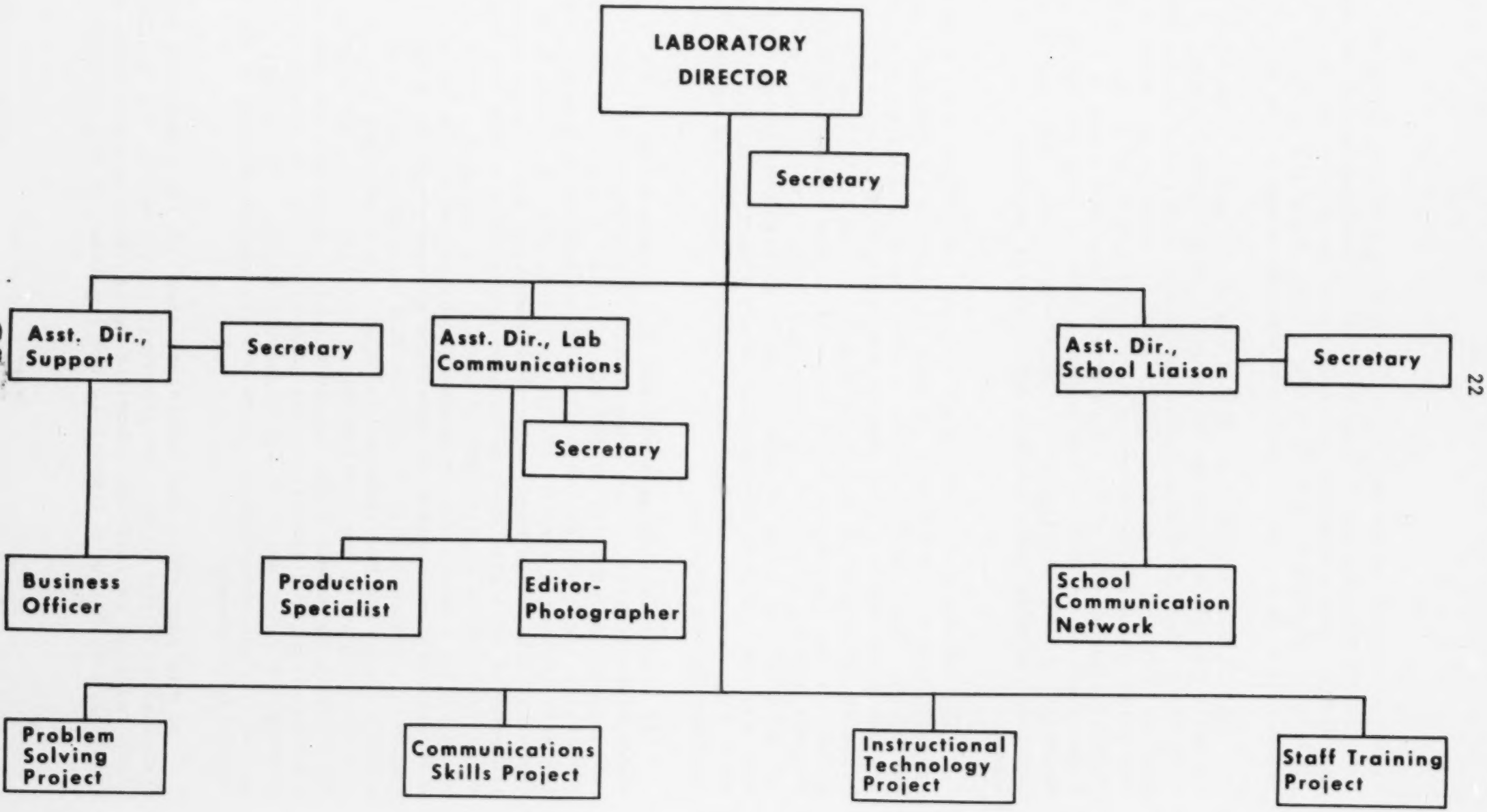

FIGURE 2

June 15,1966

FUNCTIONAL
ORGANIZATION CHART

SOUTHWEST REGIONAL LABORATORY
FOR EDUCATIONAL RESEARCH AND DEVELOPMENT

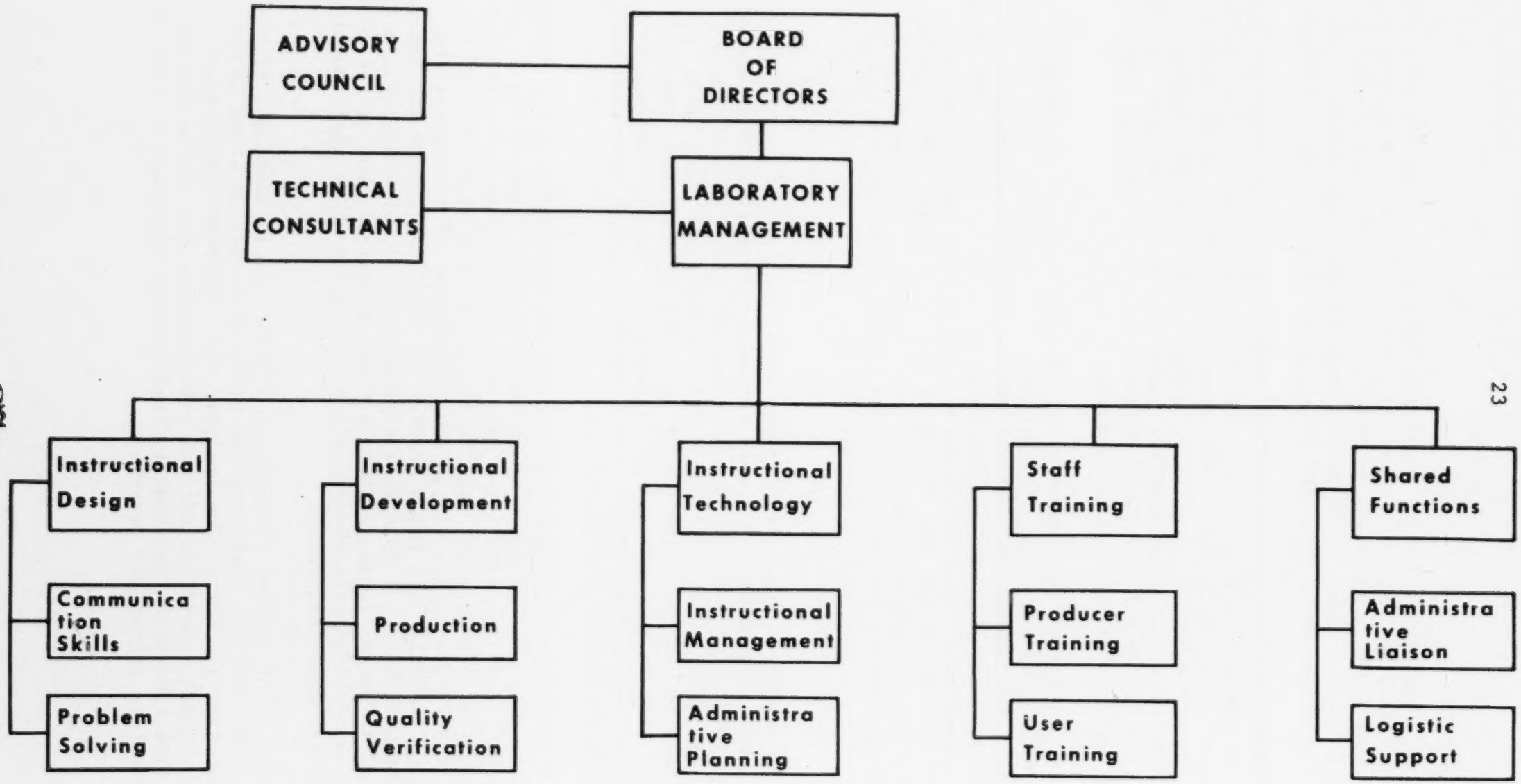

FIGURE 3
DECEMBER 1966

program. Liaison functions involving Laboratory relations with external agencies also involved all projects. The term, "Shared Functions," was thus used to categorize all of the Laboratory functions shared by the other modules. These included not only business and school liaison, but also the secretarial, art, audiovisual, and duplication functions.

This organization was modified only slightly, as shown in Figure 4, when the Laboratory entered its second contract with the U.S. Office of Education on March 1, 1967. The change involved the establishment of a new Resource-Service module to handle the liaison and communication functions which had been implicit under the Shared Functions module. This left the Shared Functions module with a more narrowly defined role, now labeled Management Support.

To illustrate how operation of the self-correcting mechanism within projects may affect the entire organization, consider the course of the Instructional Design and Instructional Development functions. Originally it had been thought possible for Development personnel to prepare prototype instruction from specifications prepared by Design personnel. This proved impossible with the personnel and technology then available. Development personnel complained that the specifications prepared by Design personnel were incomplete and Design personnel complained that the prototype instruction prepared by Development personnel misrepresented the original formulation.

An attempt was made to improve this situation by requiring Design to accompany specifications with prototype instruction that had been demonstrated to accomplish the intended objective with at least two individual children. This was a step in the right direction. However, it tended to reduce Production to an assembly-line role. When any modification or extension of the product was required beyond the prototype prepared by Design, the same difficulties described in the previous paragraph were encountered.

The reconceptualization of Design and Development which appeared to be in order is reflected in the organization chart of May 1, 1967 (Figure 5). Design activities were now aimed not at preparing instructional specifications per se, but at providing data to be used as the basis for future instructional specifications. For example, the Language Analysis unit began working on modifications of the Laboratory reading materials for Spanish-speaking children, on linguistic analyses leading to spoken language instructional materials, and on the identification of linguistic characteristics of instruction that contribute to ease of comprehension.

The Instructional Development element now included all activities associated with the instructional products currently being developed by the Laboratory. Curriculum Analysis was concerned with preparing instructional specifications and with planning curriculum content. Prototype Production and Quality Verification continued to perform the function previously described.

FUNCTIONAL
ORGANIZATION CHART

SOUTHWEST REGIONAL LABORATORY
FOR EDUCATIONAL RESEARCH AND DEVELOPMENT

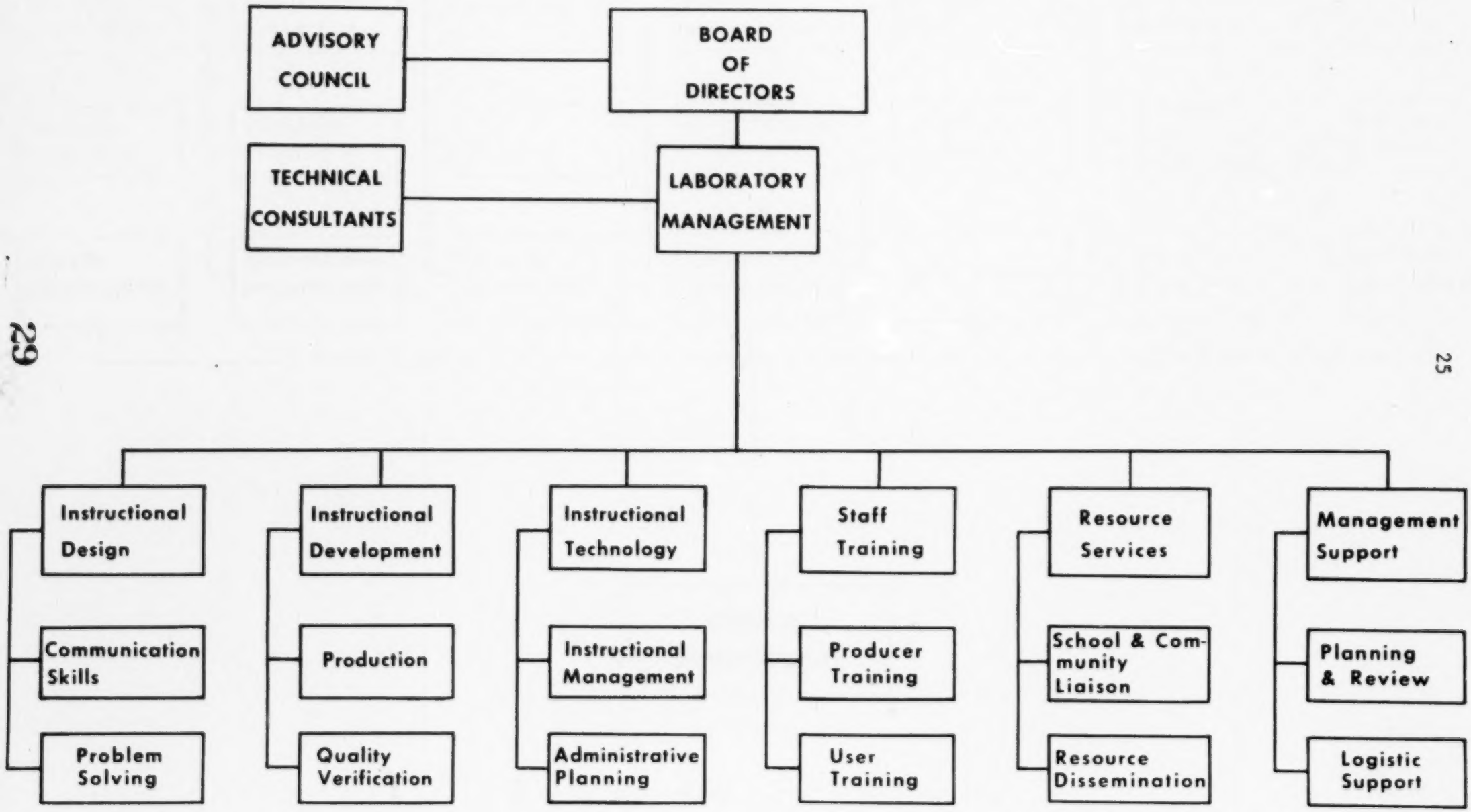

FIGURE 4
March, 1967

SOUTHWEST REGIONAL LABORATORY FOR EDUCATIONAL RESEARCH & DEVELOPMENT

PROGRAM ELEMENTS

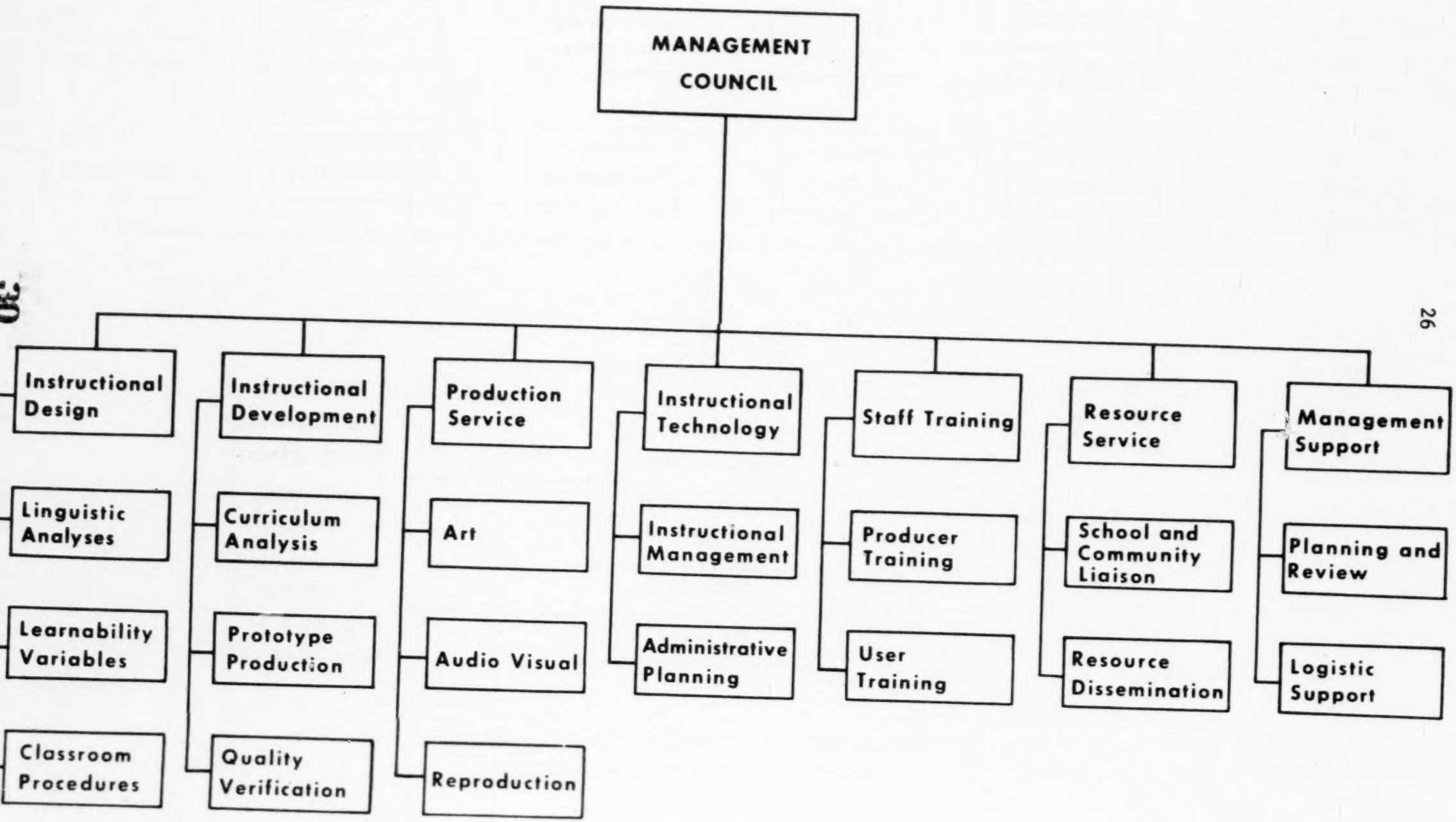

FIGURE 5
May 1, 1967

A new element, Production Services, was formed to include the art, audiovisual, and reproduction functions that had formerly been divided between Instructional Development and Management Support.

In addition to the increased clarification of functions, this restructuring led to a more manageable staff structure (Figure 5). SWRL Laboratory Management consists of those personnel appointed to positions on the Management Salary Schedule by the Laboratory Board of Directors. These included the Director, Assistant Directors, and the Heads of each of the program elements. This group formed the Management Council, responsible for planning and reviewing Laboratory activities within policies established by the Board of Directors.

The resulting administrative structure is shown in Figure 6. The functions and responsibilities of the Board of Directors and the Advisory Council remain unchanged from their original descriptions in the Joint Powers Agreement and in the Bylaws for each group. The self-correcting mechanism has somewhat redefined the roles of the administrative staff positions. While each member of the Management Council has defined responsibilities based upon specialized areas of expertise, their coordinated involvement with the total program provides continuity in forwarding the Laboratory mission.

By summer, 1968, the following situation held. Instructional Design activity appeared to be handicapped by the preponderance of inexperienced junior staff. While capable to initially probe an area, they lacked the technical competence to do so flawlessly and the experiential breadth to see the next steps clearly. The units appeared to be dichotomizing in terms of a linguistics and psychology discipline orientation. The term "classroom procedures" did not prove heuristic in generating staff activity.

Greater experience with Instructional Development had indicated that instruction is more complex than the conceptual outlines associated with curriculum analysis. Several dimensions of instructional practice in addition to curriculum had been identified.

Activities in Production Service had stabilized to providing a competent, creative support function.

Instructional Technology activity per se could be contained under subcontract management until the initial models of the Instructional Management and Administrative Planning systems became stabilized.

The completion of the first generation of staff training instruction provided the opportunity to consolidate the staff originally housed in Tempe and in Inglewood to relate further staff training activities directly to Laboratory-developed products.

SOUTHWEST REGIONAL LABORATORY
FOR EDUCATIONAL RESEARCH AND DEVELOPMENT

ADMINISTRATIVE ORGANIZATION

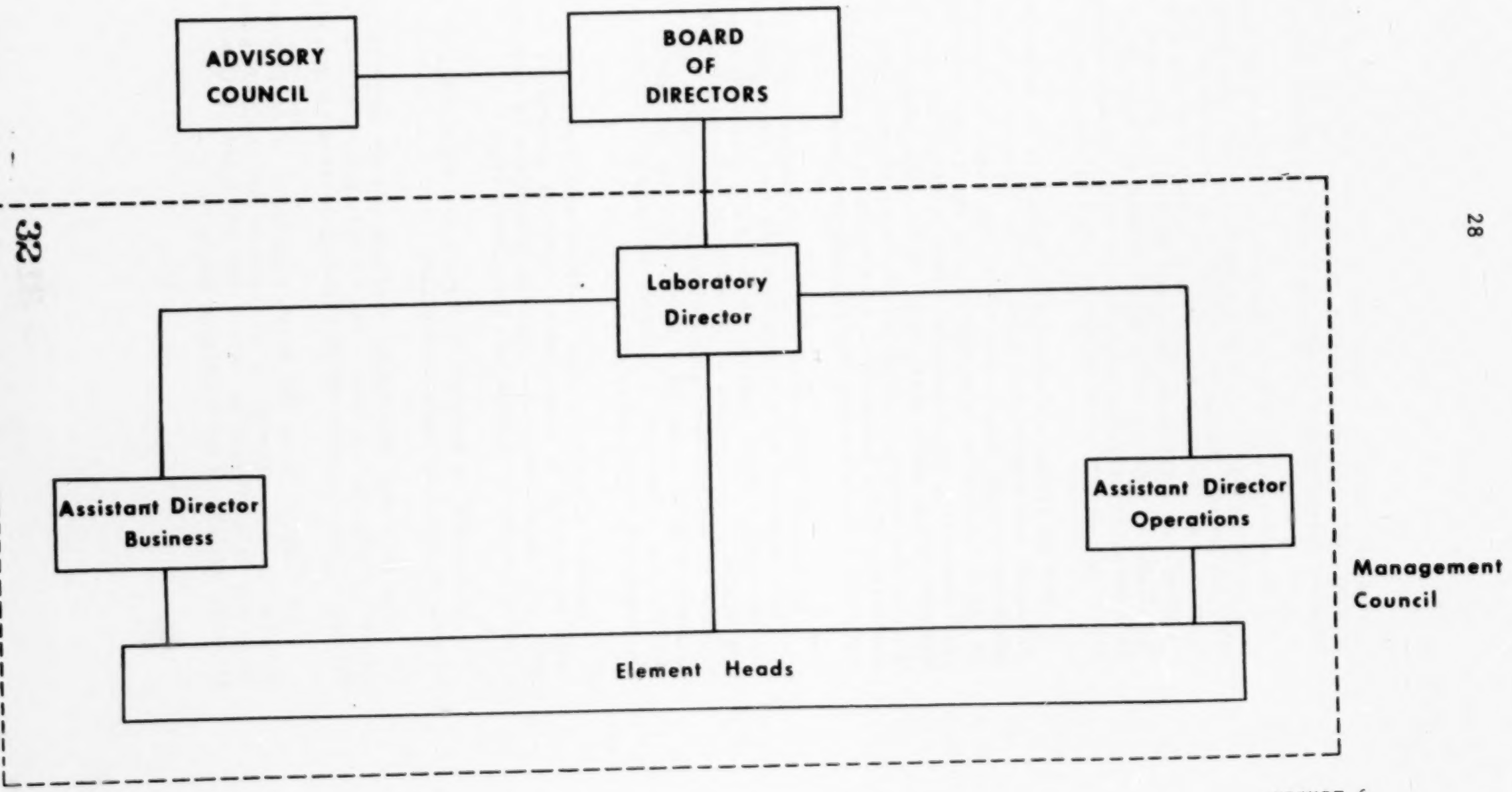

FIGURE 6
May 1967

Resource Service was achieving its intended Laboratory support objective. However, the shift and clarification of Title III directions and the resolution of public domain ambiguity had reduced the direct dissemination requirements.

Management Support had stabilized to a routine directorate responsibility.

In addition to these intra-element conditions, the complexity of the general Laboratory program had increased. A number of discrete products were nearing the installation stage. This created the requirement for large-scale tryouts with emphasis on the requirements of district administrators as they relate to product performance. Pursuit of these new requirements within the scope of Instructional Development appeared likely to dilute the ability of that element to initiate new work within present defined boundaries.

The adjustment in program elements in August, 1968, to meet these new conditions is shown in Figure 7. In an attempt to recognize personnel who had been assigned first-line supervisory responsibility, the Management Council was expanded to include such personnel. The Program Council was formed as a management subset including the directorate and element heads as shown in Figure 8.

The Management Council-Program Council administrative arrangement did not prove workable with the personnel then at hand. Unit Heads varied greatly in terms of management inclination and experience. Element Heads found it unfeasible and unreasonable to uniformly delegate planning, scheduling, and reviewing responsibility. It also became evident that clear identification of specific Management Council responsibilities was difficult; each given item proposed for Management Council consideration appeared relevant either to the Program Council or to the entire professional staff.

By May, 1969, other adjustments appeared in order. The term "element" had never been meaningful outside the Laboratory. The terms Division and Group appeared more appropriate to the current organizational structure. The ascribed status of the title, "Element Head," had been neutral at best. The term, "Manager," appeared more appropriate. At the Group level the differentiation of Group Managers and Group Leaders could distinguish personnel officially appointed to the Management Salary Schedule and professional staff whose assignment included responsibility for the work of others in addition to their own.

The increased complexity of the Laboratory internally and the increased scope of its external relations had created an unreasonable array of operational commitments for the Director. While it did not appear possible to dismiss or disregard any of the commitments, a more reasonable division of labor appeared to be in order. This was provided by establishing a directorate including the Laboratory Director, generally

LABORATORY PROGRAM

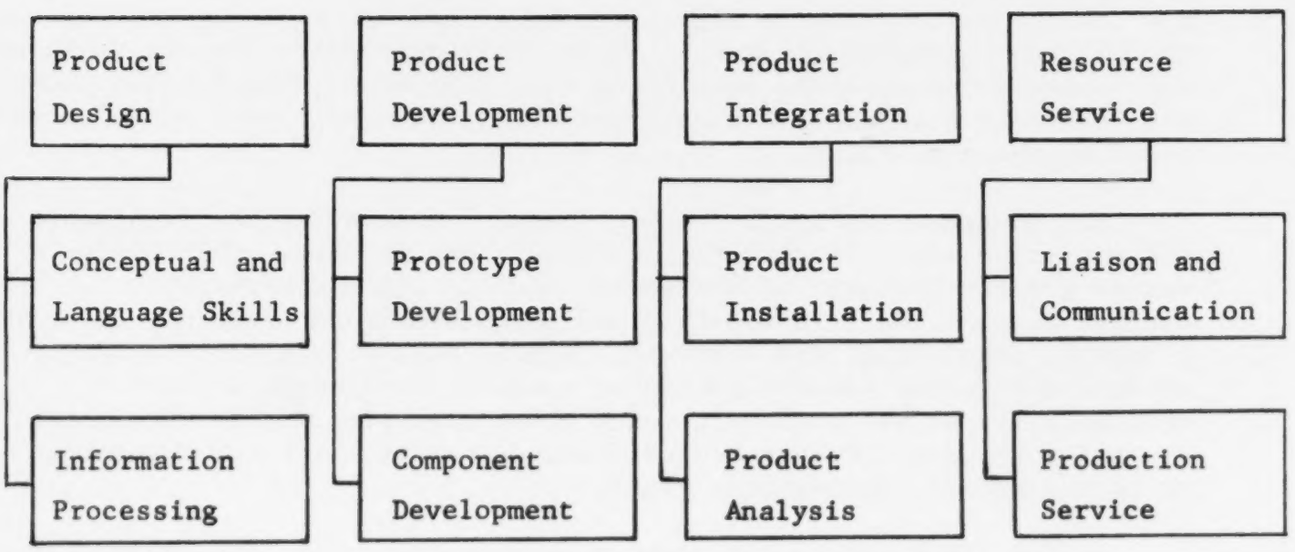

Figure 7

LABORATORY ORGANIZATION

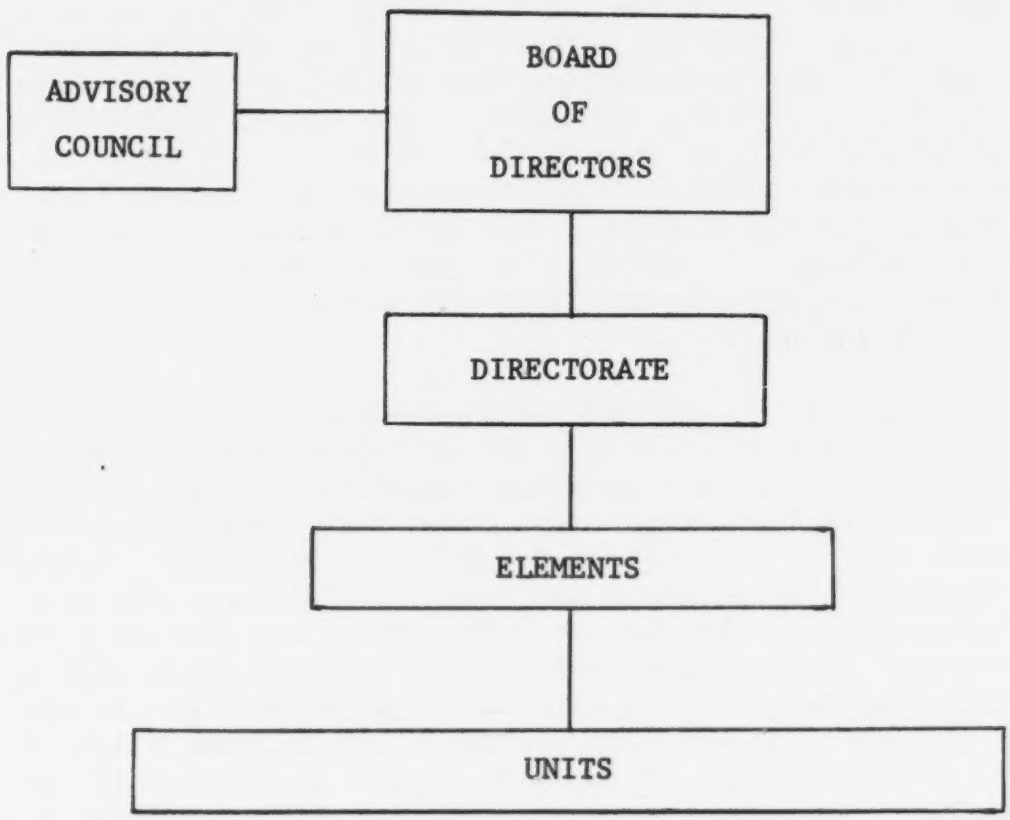

Figure 8

responsible to the Board of Directors, and Directors of Business, Operations, and Program, responsible for activities involving all components of the Laboratory.

The resulting functional organization is shown in Figure 9. The adjustment also incorporated further specificity of Group designations. Information Processing became Reading Skills, Product Analysis became Instructional Systems, and Liaison and Communication became Institutional Relations.

While the functional structure thus established was both necessary and desirable, it was neither sufficient nor smooth. Considerable effort was required to differentiate specific responsibilities both within the Directorate and within the Groups. Initial efforts to clarify division of effort within the Directorate along functional lines proved unsuccessful. In every specific instance both "program" and "planning" functions must necessarily be considered. Thus the utility of functional cues as a basis for the Laboratory structure had reached a point of diminishing returns. The solution within the Directorate was to divide effort in terms of specific individual responsibility either for personal completion of a management task or for continuous monitoring responsibility for some aspect of the Laboratory program. The result served to clarify for both members of the Directorate and for the rest of the Laboratory staff appropriate routing channels and authority-accountability limits for each specific situation.

Analogous confusion occurred within Groups. The intra-Division structure had too much function and not enough specific-task-completion. The personal goodwill and professional competence of key personnel involved were adequate to insure that tasks were completed. But Division Heads were in a particularly difficult position. Sandwiched between a functional Directorate and functional Groups, Division Heads were personally affected by the consequences of any ambiguity from either direction. Fortunately, substantial program gains were concurrently being achieved within each Division so that the stress was tolerable. Moreover, it was also possible for Division Heads to take advantage of any ambiguity, if and when "heat" was generated, by shifting the accountable responsibility to the diffused Group or Directorate.

The adjustment which appeared to be in order was a matrix structure at the Division level. This structure capitalizes upon the experience of the functional distinctions among Divisions along one dimension and adds a second dimension of activities, each with a defined scope accompanied by specified event-completion sequences.

Two matters aided the accomplishment of this objective. Program Planning Guidelines were issued to provide a framework for defining activity boundaries and task completion schedules. Concurrently, the outcomes of the Laboratory program were clarified in terms of components of educational program systems (see papers, "Subsystems of an Educational Program" and "Characteristics of Educational Program Systems").

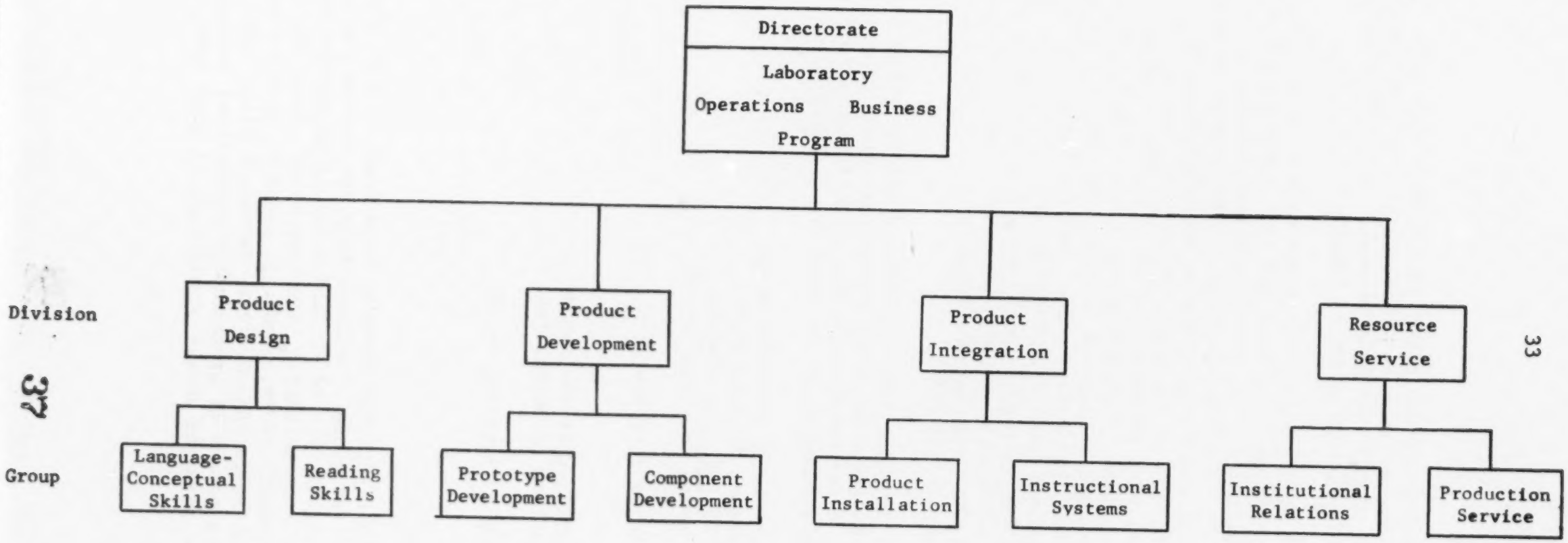

FIGURE 9

May 1, 1969

The matrix structure was formed by adding a dimension of Approved Activities, each designated a Cost/Responsibility Center with a designated Member of the Professional Staff responsible for Activity progress. The structure is shown in Figure 10.

The adoption of the matrix structure made it possible to further clarify management responsibilities and to improve management coordination and communication. The simplified organizational framework is shown in Figure 11. The Program Council continues to consist of Directorate members and Division Heads, but the nature of Program Council deliberations was modified. Heretofore, the Program Council had met periodically as scheduled by the Director. Although Council members were encouraged to submit agenda items, they infrequently did. This was due not to lack of interest, but to lack of context. From the perspective of members other than the Director, "important" matters were resolved apart from Program Council meetings, leaving only "trivial" items to suggest as Program Council agenda items. Program Council meetings provided a means of communication between the Director and the group but the balance was not optimal and the medium was not highly efficient.

Rather than a single undifferentiated general group meeting, a series of differentiated subgroup and general group meetings appeared to be in order. A two-month cycle was established, integrating the program planning documentation and deliberation as follows:

1.	CRC Heads submit to Division Heads current planning documentation (projected TS, any new Annexes, any new proposed revisions in AD)	15th of Month 1
2.	Director briefing of Division planning	15th-30th of Month 1
3.	Program Council distribution of current planning documentation	1st of Month 2
4.	Program Council briefing by CRC Heads	10th-20th of Month 2
5.	Go to Event 1	

The SWRL institutional planning time frame is five years. Having completed its first cycle, the Laboratory has resolved structural matters of initial confusion related to such terms as accountability, administration, authority, communication, cost reporting, function, governance, management, personal credit, planning, process, product, professional freedom, program budgeting, project, repsonsibility, role, and work completion. The nature of programmatic educational research and development has required unique adaptations of each term.

Cost/Responsibility Centers (1, n...q)

Divisions	
Product Design	1, 2, ...n Directed Research Pertinent to Anticipated SWRL Development Requirements
Product Development	(n+1), (n+2) .....m Instructional Systems
Product Integration	(m+1), (m+2) .....p Training Systems, Installation Systems, Accountability Systems, Modification Systems
Resource Services	(p+1), (p+2) .....q Logistical Program Support

Figure 10
May 1, 1971

LABORATORY ORGANIZATION

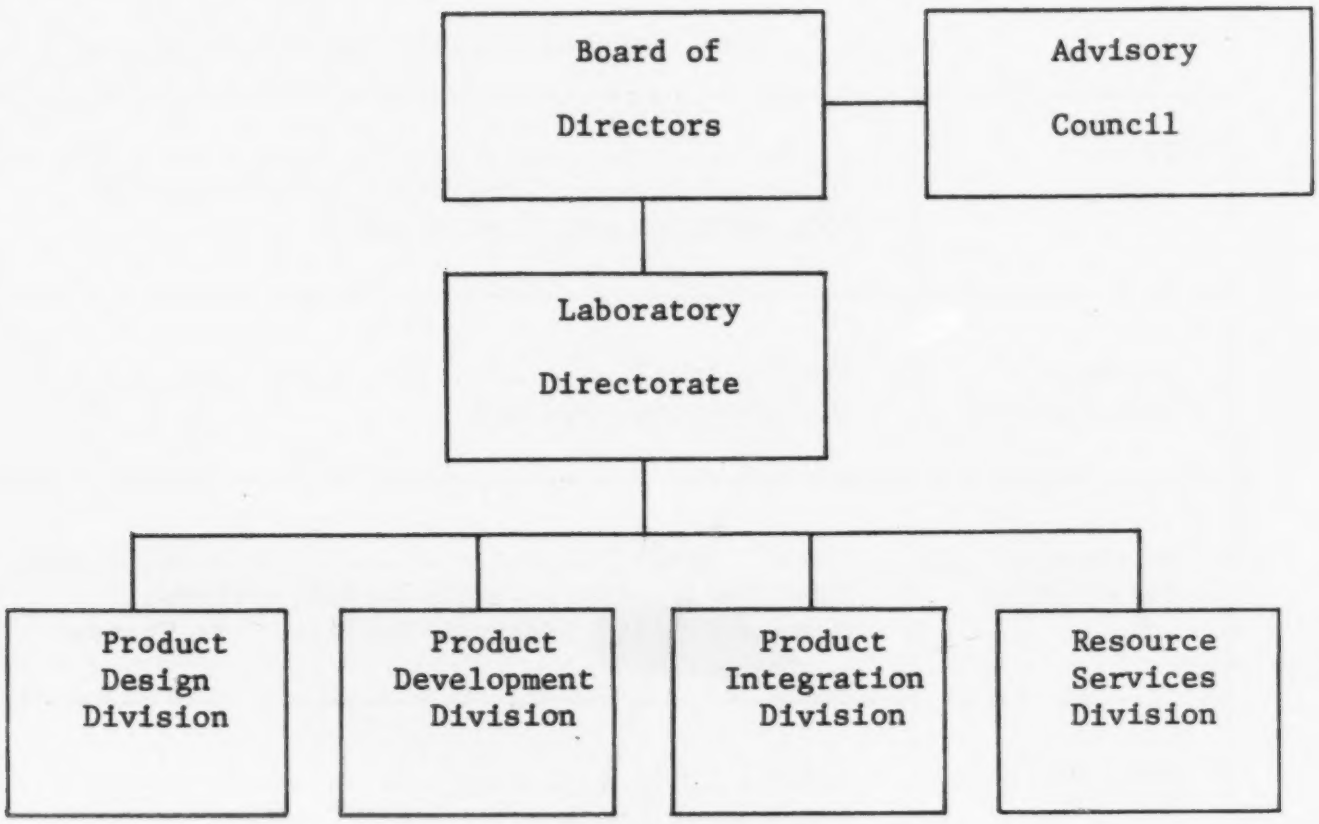

Figure 11

It is of interest that the structural organization which has evolved is in accord with the corpus of research on effective management practices. At no time did SWRL find this research sufficient to provide solutions to the problem at hand. Development, building on the research, was required. Each modification of the Laboratory internal structure has added empirical referents to the phenomenon of systematic educational development.

PROGRAM PLANNING GUIDELINES

The Laboratory program is a set of explicit but interdependent activities. The results of the activities cumulate over time to accomplish the two mission outcomes:

- Produce improved instructional outcomes by developing research-based, performance-verified instructional systems and the support systems for their effective use.

- Produce a technology providing replicable systematic procedures for effecting improvement in education.

Laboratory program planning is designed to promote the overall programmatic R&D efforts of the Laboratory and at the same time to provide maximum staff freedom to contribute to activities that have integrity and utility in their own right. Planning then is for the purpose of projecting, sequencing, and scheduling Laboratory activities which permit maximum utilization of individual capabilities and yield the most useful outcomes in the shortest amount of time at the least cost possible.

The distinctive nature of the functions performed by each Laboratory Division creates a requirement for unique Division planning considerations. These unique requirements are met by differential emphases within the common Laboratory planning framework, not by different planning frameworks. Collectively, Division planning efforts provide a means of anticipating future efforts and coordinating present efforts to cover the three- to five-year development time frame within which the Laboratory program operates.

Planning Documentation

1. Distinction Between Approved Activities and Feasibility Explorations

The Laboratory program includes two categories of effort: (a) Approved Activities; (b) Feasibility Explorations. (Activities are approved when their objectives are found both relevant to a Laboratory development effort and capable of attack in light of current or projected resources.) Feasibility explorations are approved when it appears that an additional activity may advantageously be included in the Laboratory program.

1.1 Approved Activities. An approved activity is the unit of the Laboratory program planning and budgeting system; it constitutes an area of effort to which Laboratory resources are allocated. Support for an activity continues until the need for it is met or prevailing conditions change.

1.2 Feasibility Explorations. Gaps in the Laboratory program will be perceived from time to time. Tentative proposals for new activities will result. A feasibility exploration may be distinguished from an approved activity as follows:

(1) Work seeking to evaluate the relevance of a proposed activity or Division ability to mount a cost/return-referenced useful attack on at least one facet of a potential-but-not-approved activity will classify as a feasibility exploration.

(2) Work seeking to evalute similar questions regarding some aspect of an approved activity is scheduled within the activity; hence, such work does not classify as a feasibility exploration.

2. Planning Documents for Approved Activities

Three sorts of documents are used to forward the planning of each approved activity: (a) Activity Description, (b) Task Schedules, and (c) Annex to Task Schedule.

2.1 Activity Description. The activity is viewed as a domain within the Laboratory program and consonant with the professional interests and specializations of the staff members contributing to it. Once approved, an Activity Description should warrant only annual updating unless intervening events show the need for a major reorientation. An Activity Description includes the following information:

(1) Problem. The Activity Description should begin by stating the problem, e.g.,

> A pupil subpopulation exists whose children speak a dialect of Spanish and perhaps a contact dialect based upon Spanish and English but speak and understand English poorly or not at all, with serious implications for progress in contemporary American schools.
>
> An exportable tutorial system which can be used in conjunction with the SWRL ICP Program is to be developed. The system is designed to increase instructional effectiveness through use of trained intermediate grade tutors who monitor the practice responses of kindergarten pupils scoring below a specified level on Criterion Exercises.

(2) Objectives. The general objectives of the activity should be enumerated. In practice, these will not be attacked frontally in a single pass, but rather progressively in terms of a subset of more finite undertakings. In this sense, activity objectives are more addressed than attained. (Attainment is sought for task schedules. See Section 2.2.)

(3) Plan of Attack. Plans of attack will not be treated in great detail in the Activity Description, but rather will be sketched. Degree of definitiveness of the sketch will depend upon age of the activity.

(a) If the activity is relatively new, then it may be too early to state definitively how its objectives will be attacked. In this event, the initial attack will be illustrated, using potential tasks as exemplars.

(b) If the activity has been staffed for some time, it should be possible to treat the initial attack more definitively in terms of one or more tasks. When the activity has been staffed for a period of time, such tasks will already be ongoing. The Activity Description should reveal planning progress as a function of age of the activity.

(4) Staff Resources. Total prior expenditure of Professional Man Years (PMY) in previous years should be reported, together with current and contemplated staffing for the year ahead.

2.2 Task Schedules. Each Task Schedule indicates the sequence of steps to be executed, completion dates, planned starting dates if these vary, and the staff member responsible for the completion of each step. The following format is used:

Event	Start Date	Completion Date	Responsibility

While it is desirable to prepare Task Schedules which cover as broad a scope over as long a period of time as possible, the feasibility of so doing varies with the age of the activity and nature of the task. The objective is to set forth an achievable feasible sequence. For some tasks, it may be possible to include many events over several months. For other tasks in the initial stages of an activity, only one or two events covering a few weeks may be as far as can be reasonably foreseen. For complex tasks, it may be desirable to prepare subtask schedules, each pertinent to a different facet of the task.

Task Schedules are updated as experience warrants.

2.3 Annex to Task Schedule. The purpose of an annex is to clarify or otherwise detail some aspect of a Task Schedule. Annexes will vary in form consonant with the work to be described. Annexes will most frequently elaborate procedural matters relating to method, analysis, or other pertinent aspects of the plan of attack. No embellishments or elaborate rationales are appropriate or desirable in an Annex. The Annex is a mechanism to be used as necessary to reflect clearly and succinctly what needs to be done, now it will be done, and what special support may be required.

It is important to note that detailed conceptualizations and literature reviews are not appropriate in an Annex. These should be prepared as a Reporting rather than a Planning document (Technical Note, Technical Memorandum, Technical Report). Such work should be cited in an Annex rather than presented on its pages.

3. Planning Documents for Feasibility Explorations

Proposed exploratory work is described in a SWRL Memorandum authorizing initiation of such work consonant with approved Laboratory projects. Typically, the Memorandum formalizes agreements reached during earlier conversations involving the Division and the Directorate.

(1) The Memorandum is drafted by the Division Head and, when approved, issued by the Director's office.

(2) It indicates:

(a) The domain in which new work is proposed, where the immediate requirement is to develop decision information relating to such work, and perhaps a draft Activity Description.

(b) Contemplated staffing level, in man-months, for developing needed decision information.

(c) A tentative future date at which involved personnel should meet to determine whether to continue the work as an approved activity or to table it.

(3) Should empirical probes underlying development of needed decision information be required, authorization for such probes will be sought as the need for them becomes evident.

Planning Initiation

4. Initiation of Feasibility Explorations

4.1 The objective of a feasibility exploration is to determine the consequences which would follow if an additional activity were to be included in the Laboratory program. The feasibility exploration then is directed toward preparing an Activity Description and supportive information showing that relevant information will be obtained if objectives of the activity are addressed and that staff is capable of attacking activity objectives with resources that will be available (See Section 1.2).

4.2 Exploratory work arises when someone perceives Laboratory-program defined gaps in the Division program, preliminary discussions occur, and the Director concurs that a new activity consonant with an approved Laboratory Project may be required.

4.3 The Director issues a SWRL Memorandum authorizing a limited investment of staff and other resources directed at evaluating relevance (the easier question), Laboratory capability for attacking objectives, and probable return on expenditures underlying such an attack (See Section 3).

4.4 The Division Head assigns or recruits a skeletal staff -- a key individual perhaps augmented by an assistant -- to secure the needed decision information and to draft an Activity Description.

4.5 Staff may discover that goals of the exploratory work necessitate more extensive conceptualization than originally authorized or other unforeseen steps -- e.g., empirical probes. If so, such proposed changes in approved exploratory work are described in a SWRL Memorandum from the Division Head to the Director's office and approved to execute such work requested.

4.6 Typically, skeletal staff should be able to complete a feasibility exploration, as evidenced by a proposed Activity Description, without extensive prior preparation (Format is described in Section 2.1).

5. Initiation of Activities and Tasks

5.1 Work in a domain ceases to be exploratory when the Director approves an Activity Description for such work. Each Activity Description is approved by the Director.

5.2 An approved Activity Description is authorization to get to work in a domain or to address general objectives. One gets to work on one or more tasks, each of which seeks to attain one or more specific objectives in finite, schedulable time.

5.3 Task Schedule approval is by the Directorate, unless approval for schedules within a given activity has been specifically delegated to the Division Head. Definitiveness of previous Task Schedules and related considerations will determine whether approval is delegated.

6. Production of Planning Documents

6.1 Division Heads are responsible for producing the overall Division program -- all planning documents -- and for updating it. Updating involves either obtaining Directorate approval and distributing to file holders, or Division Head approval and appropriate distribution.

6.2 The staff member assigned responsibility for an activity is responsible for forwarding all planning document information relating to the activity to the Division Head.

6.3 Activity staff are responsible for furnishing activity- and task-level planning information to the Activity Head. Senior activity staff should have cognizance of all planning documents of activities of the group.

7. Inter-Division Coordination and Support

7.1 Division Heads should keep abreast of advance information of Laboratory program plans as this appears in planning files for each Division.

7.2 Inter-Division support for approved work should be scheduled as appropriate on the basis of advice contained in the Task Schedule and supporting documents. Such support -- particularly in the form of school participation and computer concentration and analysis of data -- will need to be coordinated in advance of scheduled event performance.

7.3 Each Division Head coordinates Division requests for support to insure that these are consonant with Division capabilities for using such support. In those instances where Laboratory support groups become overloaded, he oversees rescheduling of support requirements consonant with support capabilities.

GUIDELINES FOR THE PREPARATION AND REVIEW OF TASK SCHEDULE

The Program Planning Guidelines detail the general procedures to be followed in scheduling and completing work program tasks. The implementation of these Guidelines provides a continuously current management information report of the sequenced projected completion dates of work required to meet the Laboratory's contract obligations. The remainder of this document will be devoted to a description of the information system procedures.

I. Task Schedule Preparation

An approved Task Schedule is the Laboratory's instrument for justifying the assignment of resources and monitoring progress on the current Scope of Work. Task Schedules provide the vehicle to plan and schedule the activities of the CRC as well as to credit completed work and accomplishments. The content and style of Schedules will vary with the nature of the Cost Center and its state of development. However, the following conventions serve to minimize the effort required to prepare and maintain Task Schedules.

A. Numbering. Each Cost Center is assigned a number when established. For example, 511 represents the Computer Center in Product Integration. The first task within that Cost Center should be numbered 511.1. Additional tasks are numbered 511.2, 511.3, etc. Events may then be numbered by adding a period and another digit. Thus, the first event in Task 511.2 is 511.2.1; the second 511.2.2, etc.

B. Dates and Revisions. Task Schedules become outdated as new information suggest other or additional events. To make it possible to keep track of such changes, all pages should be dated in the lower left portion of the page (see format section). Updates should be given the new date of approval and noted as: 1) Replaces Schedule (number), dated (old date), or 2) An addition to Schedule (number), dated (old date). Any modification of number sequences should be handled so as to retain a full account of the steps taken and the work actually completed.

C. Event Descriptors. Normally, each event should describe the product of a completed effort. Thus, "Prepare a TN describing tryout results," is a more suitable descriptor than "Monitor the tryouts."

When it is premature to describe events, or when a suitable reporting document cannot be referenced, insert an event labeled "Prepare an annex . . ." For example, "Prepare an annex detailing data collection procedures." Annexes should occur far enough in advance of subsequent and contingent events to permit a review and a revision when necessary.

The following lexicon derived from an analysis of current Task Schedules may be useful:

1. Verbs describing the preparation of some products, i.e., <u>to prepare</u>:

clarify	document	describe	list	revise
code	develop	draft	modify	request
compile	design	establish	outline	report
complete	determine	formulate	plan	specify
construct	define	initiate	program	select
				write

Objects of these verbs include:

planning and reporting documents	specifications
word lists	programs
stories	materials
lessons	scripts
memos	tapes
letters	analyses
forms (SWRL)	equipment

2. Verbs describing an activity performed on or to some aspect of the program, i.e., <u>to conduct</u>:

administer	consider	evaluate	monitor	test
analyze	collect	explore	perform	train
apply	demonstrate	install	review	
check out	edit	investigate	supervise	

Objects of these actions include:

briefings	tests	training	tryouts
analyses	demonstrations	evaluations	reviews
observations	investigations	meetings	

3. Verbs describing the release or turnover of output, i.e., <u>to transmit</u>:

send	forward	submit	provide

Objects of these actions include:

letters	materials	equipment	requests

D. <u>Scheduling</u>. For a Task Schedule to be useful, events must be well thought out, and the dates must be realistic. Allow about 10 working days for the review of planning documents, thus allowing time for revision. Allow 4 working days for the review of program materials, especially for the first time

through. Subsequent exemplars may take 2 days or less turn-around time. All reviews should state clearly just what is to be reviewed.

Clearly, the scheduling of dates becomes very sensitive when resources are required from other Cost Centers. The production of lesson materials, modification of a tape recorder, or identification of subjects can be handled nicely when ample notice is built into the schedule. Havoc results if one fails to signal the requirements early enough and then experiences long delays. Section IV, Resource Services Time Requirements, provides guidelines in estimating the time required for various services.

E. Format. Each Task Schedule should begin on a new page. The information should be positioned as follows:

Task	Person Responsible
511.2 -- Utility Software Development	F. Teplitzky

Event No.	Event	Start	Due	Start-up Constraints	Staff
511.2.1	(Description)	1/11/71	1/19/71	---	Abbott
511.2.2	(Description)	1/20/71	1/21/71	511.2.1	Biggs
511.2.3	(Description)	1/20/71	1/27/71	511.2.1	Biggs
511.2.4	(Description)	1/22/71	2/3/71	---	Abbott

Dated 11/30/70

(or) Dated 12/15/70 - Replaces Task Schedule 511.2 dated 11/30/70.

(or) Dated 12/15/70 - An addition to Task Schedule 511.2 dated 11/30/70.

Note that an additional column has been added called "Start-up Constraints." The sample shows that 511.2.1 is the only constraining event and event 511.2.4 is not under any constraint other than resource availability. If an event cannot be initiated prior to the completion of other events, those required events should be noted here. Events with no constraints may be started earlier than scheduled when staff time permits and/or run in parallel with other events to speed-up the activity. Wherever possible, linear Task Schedules should be avoided as they are usually wasteful of staff time.

F. Distribution. After approval, a Task Schedule is reproduced and distributed to each person holding a Program Notebook for that Division. The Program Notebook is the repository of all approved Task Schedules. Each CRC Head should have a notebook for his Division's planning documents. Each Management Secretary should maintain notebooks for all Divisions. Members of the Directorate receive all planning documents.

II. Directorate Briefing

Specific schedules are built within the following general time framework:

15th of Month 1	CRC Heads submit Task Schedules to Division's Directorate member.
15th - 30th of Month 1	Reviews conducted by appropriate Directorate members.
1st of Month 2	Approved Task Schedules distributed to Directorate.
10th - 20th of Month 2	Directorate Briefing.

III. Resource Services Rule-of-Thumb Time Requirements

The estimates below represent actual time requirements after DRS staff initiates work and remains dedicated to the project. However, these net estimates must be viewed in the context of overall times from notification to completion.

A. Library

Ready-reference questions (can be answered with dictionary, encyclopedia or directory)	1-10 minutes
Verification of bibliographies (average size - 15 items)	2 days
Photocopied and loan materials	
SWRL library	2 days
UCLA	1 week
Other libraries	2-3 weeks
Information searches	
(Example: A list of books by R. Glaser from 1967-1970)	1 week

Purchasing and processing new material for requester	3 weeks
Archives search	
One subject area or item	1 week
Comprehensive search (1966-1971)	1 week

At the beginning of university semesters and during summer, approximately 25 percent may be added to time requirements.

B. Publications - Publication Information

1. Briefs

Information received by DRS text written, revised, pictures taken, processed	2 weeks
Approval by Directors	2 weeks
Printing	4 weeks

(Information should be received by DRS approximately three months and no less than two months before briefs are needed.)

2. Public Information Packets

Materials ready Information and samples received by DRS Contents chosen; appropriate new documents	2 weeks
Approval by Directors	1 week
Preparation and assembling of packets at Production	3 weeks

(Information and materials should be prepared and sent to DRS 2 to 2½ months before packets are needed.)

3. Feedback Reports

From receipt of information to mailing out reports	2 weeks (1 week writing, 3 days approval, 2 days typing and mailing)

4. Newsletter

Information must be received by Wednesday noon of each week preceding Monday distribution.

5. School Contact Calendar

Information must be received by Thursday noon of each week preceding Monday distribution.

C. Publications -- Editing, Typing, Printing

The document publication cycle consists of 5 major phases:

Phase 1: Directorate approval

Phase 2: Initial editorial review

Phase 3: Final typing

Phase 4: Final editorial review

Phase 5: Printing

All five phases should be considered in providing the author a completion time for his document. Time factors for each of the five phases are as follows:

Phase 1: Directorate responsibility (but editor often informs author that his document is awaiting Directorate release).

Phase 2: Initial editorial review and consultation as necessary with author.

Time allocation: One week if document is less than 50 pages; 2 weeks if it is more than 50 pages. Should the author want to revise his document on the basis of editorial recommendations, the number of days required to complete the task should be added (normally a short author-editor conference will do the job).

Phase 3: Final typing.

Time allocation: Under 50 pages, 1 week; over 50 pages, 1-2 weeks.

Phase 4: Concerns 8-12 on Routing Sheet.

Time allocation: Three days.

Phase 5: Concerns step 13 on Routing Sheet.

Time allocation: Under 50 pages, 1 day; over 50 pages, 2-4 days.

D. Instrumentation Services

The time required to develop a new device for a specific application can vary from less than a day to several months. Each requirement is estimated individually. (You will be provided a specific time estimate when your request is received.)

Ordering parts usually takes at least a week.

Time required to develop new devices is affected greatly by the clarity of function specifications. If specifications are well defined, standard equipment can many times be modified to perform a different type of operation.

E. Film Services

1. 16mm - complete project - start to finish:

Length of Film	Time Required
7½ minutes	17 weeks
15 minutes	21 weeks
30 minutes	33 weeks

2. Film Revision

Time required depends on the nature and extent of the revision. Any revision at all would require a new inter-negative master, which means the original would have to be recut. This could require up to 5 weeks, including processing. The Film Department has no direct control over that phase, as the time is dictated by the schedules of the negative cutter and processing lab.

Beyond that, any revision would entail planning time, additional editing, and probably additional shooting. This could require from 2 to 6 weeks. Total revision time then would be 7 to 11 weeks.

3. Filmstrips

Production of master	8 days
Copies (less than 50)	3 days

F. Production Services

On large jobs involving more than just a few pieces, time-saving can be effected by getting the total work order approved and processed, accompanied by a schedule of when copy will be sent to Production. Thus, both the CRC Head and Production Services can schedule the work load more effectively.

1. Art Department

a) Illustrations

Realistic figures (Example: SYCSP Carmen series)	1½ hours per figure. 3-4 hours per illustration including props. Add 3 hours per drawing for color.
(All times excluding research)	
Cartoon characters (Example: SYCSP Sad Eye Sid)	1 hour per figure. 2-4 hours per illustration including props. Add 1 hour per drawing for color.
Fantasy illustrations (Example: SYCSP Transition, The Thark's Ring)	4 hours per illustion. Add 3 hours per drawing for color.
Spot illustrations (Example: car, phone, animals)	1 per hour.
Stating and paste up stating, negative and positive - 8½ x 11 one or more figures, enlargement or reduction.	6 minutes

Examples:

Storybooks, FYCSP, 16 pages, average --	
Stating	6½ hours
Paste up	2½ hours
Descriptive Writing Design Format for 11 x 17 sheet size	1 hour
Stating	1½ hour
Paste up	2 hours
Flashcards (5x8) paste up	15 cards per hour
Practice Exercises and Criterion Exercises 11 x 17 4 pages	
Stating	3/4 hour
Paste up	1 ½ hours

b) View Graphs

Production - 1 color, negative, positive, dry, burn, and mount	30 minutes (additional, colors, minutes each)
Graphics	
Text composer	8 hours
Art	1 hour per figure

c) Typesetting

Normal turn-around time	2 days
Typositor	4 minutes per word
Headliner	5 words per minute
Line drawings, average black diagrams and graphs, layout, ink, and paste up	3 hours

2. Printing

8½ x 11 - 1 side print - 50 copies	5 minutes
11 x 17 - 1 side print - 50 copies	5 minutes
8½ x 11 - 2 side print - 50 copies	30 minutes (drying time included)
11 x 17 - 2 side print - 50 copies	30 minutes
Covers - 1 side print - 50 copies	5 minutes
Score for bindings	15 minutes
Collate 50 pages - 50 copies	45 minutes
Stitch - 50 pages - 50 copies	60 minutes

(Average printer can run 200 plates, 10,000 impressions, per day.)

Vended Materials

Printing vended to GPO	3-4 weeks
Time for bidding on GPO material, if necessary	1-3 weeks
Duplicating through outside vendor, 1 to 5 sheets	1-3 days

G. Tryout Coordination

1. Initial Arrangements

a) Two - four weeks lead time is usually required to arrange field tryouts.

b) Some tryout requirements involve conditions which may necessitate 25-50 percent more lead time. Following are examples:

1) Tryouts planned to begin at the opening of the school year, when many tryouts are being scheduled. This is especially true of year-long tryouts which generally require intensive review and extensive arrangements by school district personnel.

2) Tryouts to be conducted in the spring when many of the districts located near the Laboratory are participating in ongoing studies, or have participated in previous studies during the year.

3) Tryouts on controversial subjects about which there is strong feeling among teachers and principals, or in the community.

4) Tryouts which have complex requirements for participants or necessitate tying up school facilities for long periods of time.

5) Tryouts which require special school or district personnel.

6) Tryouts which require special equipment which has to be developed within the Lab for the study. Also to be considered is the necessity of involving outside vendors to move trailers or for other purposes.

7) Tryouts are much more difficult to place after April.

2. The Extension of Tryouts

This usually requires one or two weeks, depending upon the number of schools involved and the complexity of the research.

3. Scheduling additional activities, i.e., midterm testing and/or end of tryout meetings for teachers and other school personnel.

a) One to two weeks should be allowed, especially if the district must procure substitute teachers to allow the teachers participating in the tryout to attend a meeting.

b) Two weeks should be allocated if the tryout involves many schools and a strict schedule is required for midterm or posttesting.

4. Feedback Reports

a) The results of field tryouts and/or related activities must be reported promptly in writing to participating district and school personnel. Researchers should include plans for a report upon which DRS personnel can base a brief report on the results of the tryout in their planning documents. Depending upon the nature and complexity of the tryout, the Laboratory should make feedback reports available to the participants in tryouts one to two months after the completion of the research. (See Publications -- Public Information, page 2.)

b) DRS should be notified when a tryout is completed so that "thank you" letters may be mailed to the appropriate participants promptly. These letters should go out no later than one week after completion of the tryout.

H. Scheduling Visits to School Districts

Usually one week would provide ample time. However, if the visitors are from out of the state, time for arrangements to be completed by mail should be allocated.

PROGRAM DOCUMENTATION GUIDELINES

A programmatic research and development effort necessitates careful attention to documentation. If documentation is to be an aid, not an aversion, the function and flow of various kinds of documents must be clearly specified.

Each SWRL staff member has documentation responsibilities. Each is encouraged and expected to communicate the procedures followed and the results generated in the activities in which he participates. The review of documents is designed to assist, not to censor. The purpose of the review is to eliminate duplication of effort in document preparation, to provide the author access to professional and technical assistance available within the Laboratory, and to provide an advance planning mechanism for using the document. Although the sign-off authority is specifically assigned, the use of en route self-corrective procedures will insure that review decisions seldom are sprung as surprises.

Primary responsibility for both content and expression is assigned to the author. Editing assistance is available in the Division of Resource Services. However, at the time a document leaves an author's desk, it should represent his best literary effort.

1.0 Correspondence

Function. To treat a single-purpose, for-the-occasion matter directed to specified addressees.

Examples. Typewritten "mail" to persons inside or outside the Laboratory.

Format. Letterhead for outgoing correspondence. Memorandum for internal correspondence.

Prerequisite Document. Other correspondence or none.

Review. Author.

Distribution. Designated by author. Each staff member is responsible for maintaining his own correspondence file. Inactive files are routed to the Archives, in accordance with Archive Guidelines.

2.0 Planning Documents

2.1 Projects Prospectus

Function. To describe a new area for which it is proposed that Laboratory resources be expended.

Examples. Communication Skills, Problem Solving Skills, Computer Applications, and Staff Training.

Format. See Guidelines for Preparing a Project Prospectus.

Prerequisite Document. Supporting papers or none.

Review. Executive Director, Directorate, Advisory Council, Board of Directors.

Distribution. Restricted prior to approval.

2.2 Feasibility Exploration

Function. To propose exploratory work to evaluate the relevance or cost-return worth of a potential facet of a previously-approved activity or project.

Examples. Handwriting Feasibility Study, Computer Configuration Feasibility Study.

Format. See Program Planning Guidelines.

Prerequisite Document. None.

Review. Member of Directorate, Executive Director.

Distribution. Restricted prior to approval. Internal thereafter.

2.3 Activity Description

Function. To describe an area of effort within a previously-approved project-area to which Laboratory resources are allocated. Activity Descriptions define the basic units of the Laboratory program for planning and budgeting purposes. Each Division maintains a file of Activity Descriptions which collectively reflect the current status of the Laboratory program.

Examples. Associate Director maintain files of current Activity Descriptions.

Format. See Program Planning Guidelines.

Prerequisite Document. Approved Project Prospectus.

Review. Member of Directorate, Executive Director.

Distribution. Restricted prior to approval. Internal thereafter.

2.4 Task Schedule

Function. To show the sequence of events to be completed, together with start and completion dates and personnel responsible for a defined facet of an approved activity. While schedules may be accompanied by short descriptive statements that clarify the scope of the overall effort or individual steps, longer clarifying statements should appear as Annexes (Sec. 2.5) or Program Reporting Documents (Sec. 3.0) which are referenced in the Task Schedule.

Examples. Associate Director maintains files of current Task Schedules.

Format. See Program Planning Guidelines.

Prerequisite Document. Approved Activity Description.

Review. Member of Directorate, Executive Director.

Distribution. Restricted prior to approval. Internal thereafter.

2.5 Annex to Task Schedule

Function. To elaborate or clarify some aspect of background, procedure, staffing, and/or scheduling of work shown in a Task Schedule. A literature search or other effort that can stand on its own should appear as a Reporting Document, not as an Annex or other Planning Document.

Examples. Associate Director maintain files of current Annexes to Task Schedules.

Format. See Program Planning Guidelines.

Prerequisite Document. Approved Activity Description.

Review. Member of Directorate, Executive Director.

Distribution. Restricted prior to approval. Internal thereafter.

3.0 Program Reporting Documents

3.1 Technical Note

Function. To describe a facet of a Laboratory activity which warrants being made a matter of record to establish the scope and/or chronology of the activity but which does not provide

the substance or otherwise warrant preparation as a document that stands alone for a readership outside those already acquainted with the activity.

Examples. See Annual Annotated Bibliography.

Format. See Publication Style Guidelines.

Prerequisite Document. Approved Activity Description.

Review. Associate Director.

Distribution. Distribution List. Available for internal use by request to originating Division. Available for external distribution only upon approval of originating Associate Director.

3.2 Technical Memorandum

Function. To describe a facet of a Laboratory activity of sufficient substance and import for other facets of the Laboratory program to warrant communication to interested Laboratory staff.

Examples. See Annual Annotated Bibliography.

Format. See Publication Style Guidelines.

Prerequisite Document. Approved Activity Description.

Review. Associate Director.

Distribution. Distribution List. Available for internal use by request to originating Division. Available for external distribution only upon approval of originating Associate Director.

3.3 Technical Report

Function. To describe a facet of the Laboratory work program of sufficient substance and generalizable professional import to warrant communication to a wide professional readership.

Examples. See Annual Annotated Bibliography.

Format. See Publication Style Guidelines.

Prerequisite Document. Approved Activity Description.

Review. Member of Directorate, Executive Director.

Distribution. ERIC, standard distribution lists. Available for internal use and external distribution upon request to Division of Resource Services.

3.4 Professional Paper

Function. To communicate matters of general professional interest generated by Laboratory staff but indirectly rather than directly related to activities included in the Laboratory program.

Examples. See Annual Annotated Bibliography.

Format. See Publication Style Guidelines.

Prerequisite Document. Due professional respect is shown to the priority of existing literature, the contribution of Laboratory staff, and the context of the Laboratory program.

Review. Member of Directorate, Executive Director. If Laboratory proprietary considerations are cleared, the only criterion for review is that the manuscript avoid institutional embarrassment due to inferior writing style or triviality of content.

Distribution. ERIC, standard distribution lists. Available for internal use and external distribution upon request to Division of Resource Services.

3.5 Journal Publication

Function. To transmit information related to the Laboratory work program through conventional professional communication channels.

Examples. Standard journal publications.

Format. Style guide of journal to which manuscript is submitted. See Publication Style Guidelines for required acknowledgement footnote.

Prerequisite Document. Any relevant documentation available, with due professional respect to the proprietary interests of other staff members and the Laboratory.

Review. Member of Directorate, Executive Director. The responsibility for a manuscript submitted for journal publication resides with the author. If proprietary considerations are cleared, the only criterion for review is that the manuscript avoid institutional embarrassment due to inferior writing style or triviality of content.

Distribution. Internal: As designated by author. External: The Laboratory will obtain a reasonable number of off-prints for open distribution.

4.0 Policy and Procedures Documents

4.1 Board Policy

Function. To record policies adopted by the Laboratory Board of Directors.

Examples. See Laboratory Manual.

Format. See Laboratory Manual.

Prerequisite Document. Communication included in agenda for Board Meeting, Board Minutes, or none.

Review. Board of Directors.

Distribution. Incorporated into Laboratory Manual.

4.2 Administrative Policy

Function. To record administrative policies, compatible with Board policies, adopted by the Laboratory.

Examples. See Laboratory Manual.

Format. See Laboratory Manual.

Prerequisite Document. Board Communication, Board Minutes, or none.

Review. Executive Director.

Distribution. Incorporated into Laboratory Manual.

4.3 Guidelines

Function. To record standard operating principles and procedures used by the Laboratory to accomplish recurring functions.

Examples. This document. Program Planning Guidelines.

Format. Standard manuscript.

Prerequisite Document. None.

Review. Executive Director.

Distribution. Laboratory staff; available to relevant agencies upon request.

4.4 Handbook

Function. To summarize and/or organize policy and procedure information in a form convenient for use by Laboratory staff.

Examples. Employees Handbook, Secretarial Procedures Handbook.

Format. Dependent upon requirements.

Prerequisite Document. None.

Review. Executive Director.

Distribution. Laboratory staff; available to relevant agencies upon request.

5.0 Public Information Documents

5.1 News Release

Function. To report newsworthy current events associated with major Laboratory activities.

Examples. Releases concerning meetings of Advisory Council, appointments of Graduate Associates.

Format. News release.

Prerequisite Document. Dependent upon activity.

Review. Associate Director, Resource Services; Executive Director.

Distribution. Designated by Associate Director, Resource Services, with approval of Executive Director.

5.2 Announcement

Function. To publicize Laboratory activities in which external participation is invited.

Examples. Announcement of Graduate Associate Program.

Format. As specified by Associate Director, Resource Services.

Prerequisite Document. Dependent upon activity.

Review. Associate Director, Resource Services; Executive Director.

Distribution. Designated by Associate Director, Resource Services, with approval of Executive Director.

5.3 Brief

Function. To communicate general information concerning Laboratory products or programs to a general audience.

Examples. Communication Skills Program brief.

Format. As specified by Associate Director, Resource Services.

Prerequisite Documents. Dependent upon activity.

Review. Associate Director, Resource Services; Executive Director.

Distribution. Designated by Associate Director, Resource Services, with approval of Executive Director.

6.0 Official Reporting Documents

Function. To comply with directives from the Board of Directors, Advisory Council, or a contracting agency.

Examples. Annual Budget Justification.

Format. Dependent upon requirements.

Prerequisite Documents. Requesting directive.

Review. Executive Director.

Distribution. Restricted prior to approval. Internal thereafter.

MANAGEMENT RULES OF THUMB

Division of labor -- The Laboratory encourages specialization with maximum generality rather than generalization with minimum specificity. Personnel are encouraged to be sensitive to analyzing assignments in such a way that help can be obtained from other specialists, inside or outside the Laboratory. When specialists are not immediately available, however, no job that needs to be done is below the dignity of any staff member.

Cost-efficiency criterion -- In procuring products or services of any sort, the Laboratory seeks the best. The Laboratory defines "best" in terms producing the desired consequence at the lowest possible price. An item that does not produce the desired consequence is worthless, irrespective of its cost. An item that produces a consequence at a greater cost than its competitors is wasteful, irrespective of its elegance. This criterion is used by the Laboratory in evaluating the products and services it produces as well as those it procures.

Laboratory loyalty -- The self-corrective mechanism inherently encourages dissatisfaction with present effectiveness. But as dissatisfaction with some aspect of the Laboratory arises, every effort should be made to insure that responsible parties within the Laboratory are aware of the dissatisfaction before it is discussed with parties outside the Laboratory. Dissatisfactions that are unique to a single individual and that recur despite changes in the operation are discouraged. Since the Laboratory can more easily modify procedures than personnel, dissatisfactions associated with operations stand a better chance of being reduced than those associated with personality.

Solution orientation -- The statement of a problem without an accompanying proposed solution is a liability rather than an asset. One solution to a problem is infinitely more valuable than an infinite number of proposed solutions. The Laboratory does not expect immediate complete solutions to difficult problems. It does expect steady demonstrated progress toward solutions.

Cosmetics -- The overall value of any item can be increased by grooming. In all aspects of its operation, the Laboratory seeks to distinguish between cosmetics and corpus. The Laboratory uses cosmetics, but to enhance the value of a sound corpus, rather than to hide the defects of a faulty one. Laboratory cosmetics must be functional, not gingerbread.

Unambiguous explication -- An implicit reaction is inevitably ambiguous. An explicit reaction may be either ambiguous or unambiguous. Only unambiguous explicit reactions are amenable to the self-corrective mechanism. Ergo, only unambiguous explicit reactions are of value to the Laboratory.

Differential rewards -- The Laboratory attempts to reward efforts in terms of the quality of the performance and the results produced. Every effort is made to clarify the criteria for evaluating quality, and all personnel have an equal opportunity to perform. Equal performance receives equal reward, but not all performances receive equal reward, irrespective of quality.

Highest quality = SWRL minimum quality -- The commitment of the Laboratory to the self-corrective mechanism does not commit the Laboratory to initial mediocrity. SWRL employs only personnel of the highest calibre and expects the highest possible quality of performance. Thus, the highest standards elsewhere represent minimum SWRL standards.

Controlled diffusion -- SWRL encourages regional decentralization in all aspects of the Laboratory operation. However, diffused effort is not equated with anarchy. The programmatic nature of the Laboratory makes it imperative that all Laboratory activities fit into a coherent overall planned pattern.

SWRL autonomy -- SWRL is an independent agency, operating exclusively in the public interest. The Laboratory studiously avoids duplicating the efforts of any other agency, institution, or individual. While SWRL seeks cooperation and assistance from all resources of the region, it may not accept any help which leads to favored treatment of any special interest or which in any way threatens the control of Laboratory operations by the SWRL Board of Directors.

Mutual confidence -- Initial financial support of any development effort must necessarily be based on a good deal of faith in the future. SWRL support represents faith with public funds. As rapidly as possible the Laboratory seeks to convert the faith into confidence by achieving desired outcomes. This confidence can then provide the base for a further investment in faith. The Laboratory attempts to follow the same pattern of mutual faith leading to mutual confidence in its internal operations.

CONTROL POINTS IN LABORATORY OPERATIONS

A manager cannot and should not attempt to perform all functions for which he is responsible. Indeed, he should delegate responsibility for performing as many of his duties as possible to members of his staff. At the same time, he must establish sufficient controls to insure that the delegation is not tentamount to abdication of his responsibilities. These controls may be established by concentrating upon a few operations selected because of their importance (see factors below). In this manner he can efficiently direct and monitor the effectiveness of all activities within the scope of his responsibilities through regulation and observation of only a few key functions. The controls established together with the operations to which they apply constitute a set of "control points."

The use of "control points" draws on the features of three principles of effective management, namely delegation of decision-making authority to the lowest level possible, management by exception, and management by objectives. Utilization of control points has the obvious advantage of permitting a manager to make a multitude of decisions in advance, thus providing more time for concentration on more important matters that require his personal attention. It also improves the competence and morale of his staff since they are performing more responsible tasks.

The manager should require sufficiently-detailed reporting of the operations of his control points so as to insure their effective functioning. He should also be continuously sensitive to the possibility of establishing new control points or discontinuing those that are no longer useful. The questions below are helpful in selecting activities to become points for the exercise of management control.

1. Is the activity sufficiently important to warrant control in that its discharge results in the expenditure of an appreciable amount of Laboratory resources (expenditures for equipment, supplies, facility space, staff time, etc.)?

2. Are there legal, contractual or administrative requirements to be satisfied before the activity may properly be carried out?

3. Are the costs of controlling the activity disproportionate to the potential benefits of regulation?

4. Can a workable instrument or procedure be devised that will give the staff member a sufficient basis for making supportable decisions?

5. Is the activity to be controlled of a discretionary or ministerial nature?

6. Is the activity auditable by management and auditors?

7. How often does the activity occur?

8. Can an adequate mechanism be employed that will clearly inform the staff member performing the delegated activity as to when a matter should be referred to management for action of decision?

In establishing and monitoring the effectiveness of control points, a manager can make effective use of forms together with specific attention to the authority of designated staff members to commit Laboratory resources as illustrated in Table 1. This assumes an effective forms control function which is a separate subject and not treated here.

While control points are used throughout the Laboratory management, their variety can most conveniently be illustrated within the business unit. This is detailed below. The present responsibilities of the business unit in SWRL include the following:

1. administer and disburse funds received in accordance with all legal, contractual, and auditing requirements;

2. purchase, receive, and establish controls for the use of equipment, supplies, and services in accordance with all legal, contractual, and auditing requirements;

3. recruit, select, train, and provide functional supervision of an efficient non-exempt staff;

4. obtain and maintain adequate facilities and equipment for Laboratory staff and activities.

5. administer and establish personnel procedures;

6. establish and administer wage and salary plans, and a fringe benefit package.

The control points now in effect include the following (presented in outline form):

I. Procurement of items and services from external sources

   A. Buyer is responsible for control point monitoring.

   B. May not purchase order until:

      1. properly-executed requisition is received;

      2. bidding requirements are satisfied;

Table 1

Authority to Sign Documents
Committing Laboratory Resources

KEY: A - Laboratory Director

B - Member of Laboratory Directorate

C - Restricted Authorization (the scope of the authorization must be set forth in writing by a member of the Directorate)

D - Production Manager (as authorized in writing for the purchase of production supplies)

E - Personnel Specialist (as authorized in writing by the Director of Business and Operations)

BUSINESS OPERATIONS DOCUMENTS

	Form No.	Minimum Level of Authorization Authority
Check Request	52	B
Expense Report	41	B
Field Trial Facilities	38	B
Instrumentation Services	22	C
Library Request	27	C
Materials Request	4	B
Mileage Report	15	B
Office Equipment Request	47	C
Petty Cash Voucher	56	B
Product Authorization	30	B
Property Removal Receipt	29	B
Purchase Request	3	B (D)
Request for Production	2	B

Table 1
Continued

	Form No.	Minimum Level of Authorization Authority
Special Services Requisition	12	C
Time Card	16	C
Travel Order	40	B
PERSONNEL OPERATIONS DOCUMENTS		
Clearance Sheet	36	B (E)
*Consultant Long Term (Request for Professional Services)	7	B
Consultant Short Term	9	B
Educational Assistance Application	14	B
Leave of Absence	6	B
Notice of Appointment		A
Personnel Authorization	25	B (E)
Position Request: Non-Exempt	8	B
Position Request: Exempt	8	A
Request for Absence	5	B
Request for Professional Meeting Attendance	46	B
TIAA-CREF		C

3. contractual and any other requirements are met (see Business Management Guidelines);

4. GSA and GPO regulations, if applicable, are satisfied.

C. Items purchased without compliance with procedures will be returned to vendor by Receiving.

1. Vendor may be removed from accepted-vendor list if he violates purchasing procedures.

D. Unfilled purchase orders are cancelled sixty days after issuance.

1. Buyer will first check with requesting staff member to see if adequate reason exists to keep open.

II. Receipt of items purchased from outside sources (Receiving)

A. Senior Business Service Aide is responsible for control point monitoring.

B. Item may not go to requesting staff member until:

1. item checked for compliance with specifications;

2. shipping documents checked for compliance with purchase order; and

3. inventory requirements are completed for equipment.

C. Librarian responsible for receiving of library items.

III. Recruiting and hiring exempt and non-exempt staff members.

A. Personnel Assistant is responsible for control point monitoring.

B. No one will be placed on payroll until:

1. If exempt, the Executive Director signs the person's application blank and indicates the salary, starting date, and position classification; or

2. if non-exempt, the Director of Business and Operations signs the person's application blank and indicates the salary, classification, etc.

C. All recruiting and processing of applications must follow the procedures set forth in approved Guidelines.

D. Must be current contract or notice of appointment for all exempt employees.

E. Each entering employee must process through Personnel Office.

F. Each departing employee must complete exit procedures before final paycheck will be issued.

1. Procedure chart set forth on applicable form must be followed.

G. Personnel authorization form must be issued for change of status or salary.

IV. Hiring consultants and temporary non-exempt employees.

A. Personnel Assistant is responsible for control point monitoring.

B. No consultant will be paid for services unless current contract is in effect.

1. Hiring of consultant must follow Guidelines.

C. Personnel will obtain temporary help from outside sources.

1. Memo approved by member of Directorate is sent to Personnel requesting type of help and length of time required.

a. Memo must state that existing Laboratory staff in other Divisions cannot provide needed help.

V. Travel

A. Personnel Assistant is responsible for control point monitoring.

B. Properly-executed travel request must be on file with Personnel before tickets are released.

1. Travel agency has been instructed to mail all tickets to Personnel.

2. Personal travel connected with authorized Lab travel is to be billed to individual staff member by travel agency.

C. Management Secretaries will place ticket orders after approval of travel request.

D. Management Secretaries are responsible for the preparation and submission of all travel invoices of staff members within their areas of responsibility.

1. Must comply with contractual requirements as to type of travel authorized and Laboratory travel policies.

2. Must first comply with the applicable procedures if travel is for conference or professional meeting attendance by staff member.

E. Accountant will audit travel invoices for compliance with Laboratory travel policies.

1. All consultant travel must comply with all of the above, (e.g., travel orders, reimbursement requests, etc.).

VI. Attendance and absences

A. Chief Accountant is responsible for control point monitoring.

B. Must be a properly-executed absence form for vacations and sick days.

C. Management Secretary must call Accounting with report of absences each day.

1. Management Secretaries must insure that absence forms are completed and submitted for all absences of staff members within their areas of responsibility.

The above discussion focuses on the acquisition of service and items from outside sources. Laboratory resources are also expended by the staff's use of internal resources such as the Computer Center, Production, Instrumentation, and Audio Visual. Control points are similarly used in the management of these internal resources. For example, in Production, the Production Manager is responsible for monitoring the control point. A properly-executed request for production approved by a member of the Directorate must be received before art, graphics, or other production work will be performed. Analogous procedures are followed in the Computer Center and Instrumentation/Audio Visual units.

The Program Planning Guidelines and the Documentation Guidelines presented elsewhere in this report provide sets of control points for these important aspects of the Laboratory Program.